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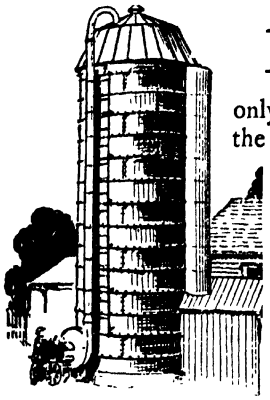

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 1.

APRIL, 1927.

NOTES FOR THE MONTH

The International Institute of Agriculture

A SHORT note was given in the JOURNAL, of June last, regarding the progress then made in connexion with the Institute's proposal to hold a World Agricultural Census in 1929-30. A proposed form, containing the various main headings in respect of which the information is to be collected, was approved by the General Assembly in April last, and for a number of months Mr. Estabrook, the Director of the Census, has been engaged in visiting the authorities of the various countries of Europe and North Africa with a view to securing that the Census is taken on the general lines proposed by the Institute. As a result practically all the countries visited have provisionally accepted the proposals. Mr. Estabrook is now leaving for America and Japan on a similar mission.

The Institute has been in communication with the various Governments regarding the possibility of obtaining more complete statistics regarding production, imports and exports, stocks and consumption of wool. In its communication, the Institute remarked that, while estimates of production are already available in respect of some of the more important wool-producing countries, the data are frequently published too late to be of any very great practical value to traders, and are in general not sufficiently informative as to the quantities of the different types produced. Statistics of trade are not in any way uniform, while as regards stocks the importance was stressed of the necessity of securing reliable estimates, the absence of which has no doubt had considerable bearing on the wide and rapid fluctuations in prices which have occurred in recent years. It is to be noted that the International Wool Conference held in Turin last October unanimously recognized the necessity of establishing universal statistics of the production and consumption of wool. This subject was also considered at the recent Imperial Conference, and a resolution was passed

recommending that steps should be taken to secure the co-operation of foreign countries with Governments of the British Empire in the collection and publication on a uniform basis of international statistics regarding the production, stocks and consumption of wool.

Another matter to which the Institute has been giving attention recently is that of Forestry Statistics. The Forestry Congress, which was held in 1926, passed a resolution urging the Institute to take up this question, and proposing that Governments should be asked to make a special contribution for the purpose of establishing a Bureau of Forestry Statistics. The Institute is at present considering the best way in which to give effect to the terms of this resolution.

* * * * * *

Fruit Marketing in England and Wales*

THE latest volume of the Ministry's series of marketing reports "has been prepared by the Ministry with the object of providing home growers with a comprehensive view of the methods of marketing fruit, and enabling them to consider what further steps can be taken by them to maintain their present position in the home market, and also, if possible, to increase their share of the total trade. . . . The conclusion to be drawn from the report seems to be that the fruit industry generally has much to gain by adopting methods of marketing which will enable produce to be put on the market in a manner more in accordance with the requirements of wholesalers and retailers."

The above quotation sounds the keynote of the report, namely, that the fruit industry should not be regarded from an angle of vision peculiar to the grower, but must be examined in the light of the requirements of distribution and adapted, where necessary, to conform with the needs and preferences of the market which, in their turn, are dictated by the consumer. The first essential for successful selling in any market is a knowledge of what the market wants.

Starting with a geographical survey of the sources of production at home and abroad, the first part of the report closes with a statistical analysis of supplies and prices. The second part is concerned with the critical steps of preparation for market, including picking, grading, packing, and that all-

* *Fruit Marketing in England and Wales:* Economic Series No. 15, Ministry of Agriculture and Fisheries. Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller. Price 6d. net, postage extra.

important means to improved marketing, namely, standardization. Then follow chapters dealing with three further stages preliminary to the final marketing of fruit, these being assembly—and here the significance of packing stations is discussed—conservation by storage, canning or other means, and transportation by rail or road.

In Part VI the story of the final stage is told, chapters being devoted to grower-retailer and grower-consumer sales, to the personnel of the wholesale trade (brokers, commission salesmen, commission buyers and wholesale merchants), to the port auctions, to the London and provincial wholesale markets, to the retail trade, and, finally, to the origin and prevention of gluts.

Part VII relates the steps that have been taken to advertise fruit in this country and affords some explanation why the home grower has not fully benefited from advertisement in the past. In Part VIII an account is given of the degree in which each section of the industry is organized.

Perhaps the most important chapter in the report is that in which the progress of standardization at home and abroad is reviewed, grades and standard packages for home-produced fruit are put forward, and a method outlined by which they might be made operative. These suggestions are submitted as a basis for discussion, and it will be for the industry to say whether action is required and, if so, on what lines, but it is clear that consideration of the standardization proposals contained in the report is a matter of great moment at the present time, and not least because of their bearing on the pressing and intricate problem of how home produce can be effectively advertised. Standardization is the foundation of successful advertisement. As the Linlithgow Committee pointed out nearly four years ago: "The British producer must break the inertia of custom; standardization, with organization, is the direction in which he must set his future course."

Every fruit grower and every distributor, whether wholesaler or retailer, should carefully study the report, which is exceptionally well illustrated and, with the aid of the grant recently made to the Ministry by the Empire Marketing Board, has been placed on sale at the nominal price of 6d. in order that it may be within reach of all. It is to be hoped that growers' organizations will aid in ensuring the widest possible circulation of the report among their members. Nearly 3,000 copies of the report were sold before publication.

Fertilizers and Feeding Stuffs Act Committee

THE Advisory Committee provided for in Section 23 of the Fertilizers and Feeding Stuffs Act, 1926, has now been appointed jointly by the Minister of Agriculture and Fisheries and the Board of Agriculture for Scotland. Its constitution is as follows :—

Lord Clinton (Chairman).
Mr. E. Richards Bolton, F.I.C.
Mr. E. G. Haygarth Brown, I.S.O.
Dr. Charles Crowther, M.A., Ph.D.
Mr. J. Garton.
Mr. C. W. Higgs.
Mr. Arthur Holgate.
Mr. Thomas Kyle.
Mr. Alexander Main, M.A., B.Sc.
Mr. John C. Menzies.
Mr. Brian S. Miller.
Lt.-Col. R. L. Norrington, C.M.G.
Mr. J. W. Pearson.
Mr. R. R. Robbins, C.B.E.
Dr. G. Scott Robertson, D.Sc., F.I.C.
Sir E. J. Russell, O.B.E., D.Sc., F.R.S.
Mr. John Speir.
Mr. George Stubbs, C.B.E., F.I.C.
Dr. J. F. Tocher, D.Sc., F.I.C.
Dr. J. A. Voelcker, M.A., Ph.D., D.Sc., F.I.C.
Prof. T. B. Wood, C.B.E., M.A., F.I.C., F.R.S.

Mr. H. J. Johns, of the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1, is the Secretary. The immediate duties of the Committee will be to prepare recommendations as to the regulations which will require to be made before the Act can come into operation, and to consider a number of suggestions with regard to the contents of the Schedules to the Act.

* * * * * *

Notes on Bulb Mites and Eelworms

THE following note has been communicated by Mr. A. S. Buckhurst, of the Ministry's Plant Pathological Laboratory.

In 1925 small experiments were carried out with bulb mite (*Rhizoglyphus echinopus*) and with the potato race of the stem eelworm (*Tylenchus dipsaci*).* In continuation of these experiments further small trials were undertaken in 1926, in order to confirm or amplify the results obtained in the previous year.

Bulb Mite.—The question whether the bulb mite is capable of causing serious injury to healthy bulbs has often been

* This JOURNAL November, 1925, p. 736.

FIG. 1.—Hyacinths infected with Bulb mite.

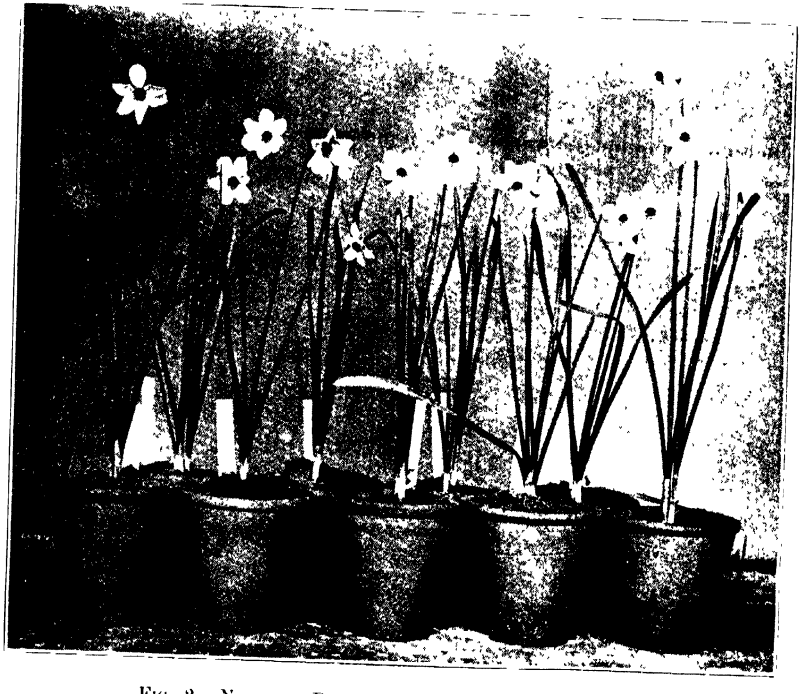

FIG. 2.—Narcissus P. ornatus infected with Bulb mite.

To face pag. 1

debated, and it is one of some importance to the bulb trade, especially to those interested in exporting bulbs to countries overseas. In an attempt, in 1924 and 1925, to obtain further light on this question, several varieties of narcissus and a small number of hyacinths were infected with mites and were grown on to determine if damage was caused by the mite attacks. In this experiment the only bulb which showed any trace of damage was a single *Narcissus poeticus ornatus*. In 1925–26, a further trial with a greater number of this variety was therefore carried out, and a number of hyacinths were included in the experiment, as only a very small number (eight bulbs) had been tested during 1924–25.

The general procedure followed was the same as that adopted in the experiment of the previous year: 65 hyacinths, mixed, and 50 *poeticus* were used, 50 of the hyacinths and 35 of the narcissus being infected with mites, the remaining 15 of each being uninfected and acting as controls. About 100 mites, taken from a culture fed upon diseased narcissus and hyacinth, were placed on each bulb, being introduced into the neck of the narcissus bulbs and between the scales of the hyacinths at the time of planting. The bulbs were potted in October in sterilized soil, plunged in an ashbed, and covered with sterile fibre. The bulbs were again allowed to flower in the ashbed, and, with the exception of one narcissus control, which was destroyed by eelworm, all produced good normal flowers. The infected bulbs are illustrated in the accompanying plate, Fig. 1 showing the hyacinths in the ashbed, and Fig. 2 a selection of the narcissi, this being necessary, as the time of flowering was rather irregular. At the end of the season, mites were found to be present on all the bulbs, both infected and control, but no damage whatever was apparent. This experiment seems to confirm the impression gained in 1925 that under normal circumstances the bulb mite is not a primary pest to either narcissus or hyacinth. So far as these plants are concerned, therefore, it is believed that, provided the bulbs are sound and of good health, the presence of bulb mites is of no importance. Where, however, there is disease present, or where the bulbs are suffering from unfavourable conditions, as, for instance, from being kept out of the ground too long, then the bulb mite seems capable of extending the damage due to the disease, or of starting an attack on any tissue which is unhealthy.

Stem Eelworm.—One of the strangest characteristics of this and some other species of eelworm is the development of races

or strains confined, or apparently confined, to certain food-plants, and since the only method of dealing with eelworm-infested land is to "starve out" the pests by not growing crops susceptible to attack, it is of great importance to know which crops are subject to attack by each strain. In this connexion, it may be recalled that, within the last few years, a potato strain of the stem eelworm has been discovered, and, in 1925, attempts were made, without success, to infect oats by means of eelworms taken from potato. In 1926, a similar attempt was carried out with narcissus.

Twelve bulbs each of Golden Spur, *Barrii conspicuus*, and *Poeticus ornatus* were potted in sterilized soil, a single bulb to each pot. Potato tubers, heavily infested with eelworm, were cut up and the pieces mixed with the soil in 18 pots, six of each variety of narcissus. The other 18 pots were not infected and acted as a control. A further control was obtained by planting potatoes in two pots into which infected material had been introduced. The narcissi all flowered normally, and the foliage showed no signs of eelworm attack, nor were any traces apparent in the bulbs on lifting. The two potatoes, however, both produced tubers heavily infested with eelworm. Although carried out on such a small scale, this experiment seems to indicate that stem eelworms from potato will not readily infect narcissus; and there would seem as yet no reason, so far as eelworms are concerned, why potatoes should not be planted on land which has previously carried narcissi and *vice versa*.

* * * * * *

The Agricultural Census of England and Wales

THE Report* on the results of the statistical inquiries made in 1925, in connexion with the Census of Production, as to the output of all kinds of agricultural produce and as to the agricultural industry generally was issued on March 18. A brief survey of the changes shown by the agricultural statistics of the last fifty years is also included in the Report.

The summary of the figures of output shows that the estimated total value of the output from the agricultural holdings of England and Wales in 1925 was 225 millions sterling and of this total live stock and live stock products accounted for rather more than two-thirds, farm crops for

* *The Agricultural Output of England and Wales*, 1925. [Cmd. 2815.] Price 3s. 6d. net, or 3s. 9½d. post free, to be obtained from H.M. Stationery Office at the addresses shown, or through any bookseller.

about 20 per cent., and fruit, vegetables, glasshouse produce, etc., for nearly 11 per cent. The report contains details of the production and output of each kind of agricultural produce and a large number of maps are included showing the distribution of crops and live stock throughout the country.

The results of a special inquiry as to the capital employed in agriculture and the average rents of agricultural holdings are included in this publication. It is estimated that the amount of capital employed as "tenant's capital" in England and Wales is about 365 millions sterling, and that the value of the land with the necessary houses, buildings, etc. (*i.e.*, what is usually known as "landlord's capital"), is about 815 millions sterling. The varying amount of capital required and rents paid for holdings of different types and sizes in different parts of the country is shown in the Report.

There are chapters dealing with employment in agriculture and the motive power used on farms. It is shown that the number of persons engaged in agriculture and horticulture in England and Wales is about 1,100,000, of whom about 800,000 are employees and 300,000 are farmers, market gardeners or nurserymen who are either employers or working on their own account. A comparison of the numbers of persons engaged in agriculture over a series of years is also given. The figures of the number of engines in use on agricultural holdings as compared with pre-war are of interest in showing the very rapid extension in the use of oil or petrol engines. In addition, there are chapters dealing with the prices of agricultural produce, with the number of holdings of different types and sizes on which the industry is conducted, and the distribution of crops and live stock thereon.

This Report should be of great value to all persons interested in agriculture.

* * * * * *

Marketing Demonstrations at Agricultural Shows

As stated in the March issue of this JOURNAL, an essential feature of the Ministry's programme of marketing work is the practical demonstration, at agricultural shows, of improved methods of marketing, including packing and grading. The commodities to be dealt with during the coming summer are eggs and poultry, fruit, potatoes, pigs and pig products.

The demonstrations contemplated by the Ministry involve much organisation of an intricate and difficult kind. Suitable buildings have to be arranged for and specially adapted to the

purpose in view. A large amount of equipment and machinery of various kinds, including refrigerating plant, has to be brought together, and installed. Live pigs and poultry, dressed carcasses of pork and dressed poultry, sides of bacon and supplies of eggs, potatoes and fruit, all of various grades, have to be assembled in the right condition, at the right time and at the right place. Posters and diagrams have to be prepared and explanatory leaflets drafted and printed. In addition, assistants have to be specially trained for demonstrating.

There are obvious physical limitations to the number of such demonstrations which can be arranged during any one show season; while coincidence of dates is a further limiting factor. For the present year, the Ministry has decided, therefore, to confine the demonstrations to the shows mentioned in the subjoined list. The proposals in regard to the shows later in the year are naturally of a provisional character, as definite arrangements are not yet possible, but the full list is given to show what is at present contemplated.

Show	Place	Dates	Subjects
Oxfordshire	Oxford	May 18 and 19	Eggs and Poultry.
Bath and West	Bath	May 24 to 28	Eggs and Poultry; Pigs and Pig Products; Fruit.
Suffolk	Ipswich	June 2 and 3	Eggs and Poultry.
Three Counties	Worcester	June 7 to 9	Fruit.
Cornwall	Truro	June 8 and 9	Eggs and Poultry.
Lincoln	Spalding	June 22 to 24	Eggs and Poultry.
Royal	Newport	July 5 to 9	Eggs and Poultry; Pigs and Pig Products; Fruit.
Yorkshire	Darlington	July 19 to 21	Eggs and Poultry; Pigs and Pig Products.
Royal Welsh	Swansea	July 29 to August 2	Eggs and Poultry; Pigs and Pig Products.
Durham Potato	Newmarket, Durham	Not yet known	Potatoes.
York Potato	York		Potatoes.
Lincolnshire Potato	Spalding		Potatoes.
Lancashire Potato	Ormskirk		Potatoes.
Dairy	Agricultural Hall, London	October 18 to 21	Eggs and Poultry; Pigs and Pig Products.
Imperial Fruit	Manchester	Oct. 28 to Nov. 5	Fruit.
Norwich Fat Stock	Norwich	November 17 to 19	Pigs and Pig Products.

Show	Place	Dates	Subjects
Birmingham Fat Stock	Birmingham	November 26 to December 1	Eggs and Poultry; Pigs and Pig Products.
Smithfield	Agricultural Hall	December 5 to 9	Pigs and Pig Products; Potatoes.
West of England	Plymouth	December 14 and 15	Pigs and Pig Products.

* * * * * *

Egg Marketing

IT will be recalled that, in January of last year, the Ministry issued a *Report on the Marketing of Eggs in England and Wales*, this report being No. 10 of the Economic Series. It surveyed the whole marketing field, and made a number of suggestions for the consideration of all interests concerned. Following the issue of the report, the National Farmers' Union and the National Poultry Council formed a Joint Committee for the purpose of examining these and other proposals for improving marketing methods. This Joint Committee has recently called into consultation representatives of the distributive trade.

In these circumstances, and as a matter of interest, it has been arranged to reprint in this issue (see p. 25) an explanatory article on the Marketing of Eggs Acts, 1924 and 1926 (Northern Ireland), which appeared in the *Scottish Journal of Agriculture* for January last.

The writer of this article, Dr. Gordon, concludes his review by the following observations :—

> The results achieved in the short period that has elapsed since the Act of 1924 came into operation have far exceeded the Ministry's anticipations. It is a fact that a most gratifying improvement in the methods of marketing Northern Ireland eggs generally has been effected. The best graded eggs from our small area are now securing, across the Channel, prices equal to those for foreign eggs of the best quality, and, in some instances, indeed, they are quoted higher. It is the intention of the Ministry not to relax its efforts until the desired object has been attained of placing Northern Ireland eggs in the premier position on the markets of Great Britain.

It will be recalled that legislation on similar lines is in force in the Irish Free State.

THE King has been pleased to appoint a Royal Commission on Land Drainage with the following Terms of Reference :—

Royal Commission on Land Drainage

"To inquire into the present law relating to Land Drainage in England and Wales and its administration throughout the country, to consider and report whether any amendment of the law is needed to secure an efficient system of arterial drainage without undue burdens being placed on any particular section of the community, and to make recommendations having regard to all the interests concerned."

The members of the Commission will be as follows :—

The Rt. Hon. Lord Bledisloe, K.B.E. (Chairman).
The Lord Clinton.
Lt.-Col. Sir George Courthope, Bt., M.P.
Lt.-Col. F. D. W. Drummond, C.B.E.
Sir George Etherton.
Mr. Leopold Harvey.
Major. J. W. Hills, M.P.
Mr. H. A. Learoyd, M.A., LL.B.
Sir Joseph Priestley, K.C.
Sir Albert Pritchard.
Mr. Rowland R. Robbins, C.B.E.
Mr. Walter R. Smith.
Mr. H. Meadows
Mr. D. B. Toye, O.B.E. } Joint Secretaries.
The Hon. Arthur Peel, Assistant Secretary (unpaid).

Since the war, especially as a result of the impetus afforded by the Lane Drainage Act, 1918, there have arisen in various drainage districts, all over England and Wales, difficulties of great and increasing magnitude. The main cause of this is probably to be found in the fact that the drainage legislation of this country, which is largely based on a Statute of Henry VIII, is inadequate and unworkable in the light of modern conditions. The Government have therefore come to the conclusion that the whole of the present drainage law requires to be closely examined with a view to possible alteration, and it is with this object in view that the Royal Commission has been appointed.

All communications relating to the Royal Commission should be addressed to the Joint Secretaries to the Royal Commission on Land Drainage, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

CHARACTERS WHICH DETERMINE THE ECONOMIC VALUE OF GRASSES

II. RATIO OF LEAF TO STEM

PROFESSOR R. G. STAPLEDON, M.A.,

Welsh Plant Breeding Station, Aberystwyth.

IN the previous article it was shown that the blade or lamina of the leaf of grasses is very decidedly richer in nutrients than either the sheath of the leaf or the stem proper.

Preference by Sheep.—Observations made during a number of years have also shown that sheep, in particular, display a strong preference for leaf over sheath or stem. Recent trials at Aberystwyth have proved that sheep do, in fact, graze leaf blades more freely than stem, while they also graze green leaf in preference to the burned leaf of grass or to weeds. These experiments have been conducted by sampling a series of plots before a grazing period and again immediately afterwards.* The grazing has been very heavy for a few days between each sampling in order to reduce to a minimum any error due to contemporaneous growth. A synopsis of results so far obtained is given in Table I. The figures represent the percentage amount of the total weight of each part of the grass available which has been eaten by the sheep.

TABLE I.—TO SHOW THE PERCENTAGE AMOUNT OF THE DIFFERENT PARTS OF THE RYE-GRASSES† EATEN BY SHEEP DURING AN INTENSIVE GRAZING PERIOD OF A FEW DAYS

Separations brought under consideration	Date of Grazing Period				
	July, 1926‡	Aug., 1926‡	Jan., 1927§	Mar., 1926§	Mar., 1926§
Stem and (or) sheath..	24	33	49	35	15
Leaf: green	66	68	79	76	70
Leaf: burned ..	—‖	—‖	50	34	9
Approximate age of herbage when grazed	4 weeks	6 weeks	6 weeks	3 months	6 months

† Results quite similar in character have been obtained with Cocksfoot.

‡ Perennial Rye-grass.

§ Italian Rye-grass.

‖ Burned foliage wholly absent.

It will be noted that a far larger proportion of the leaf than of the stem has been eaten on each occasion—two-thirds

* See "The Animal Complex and the Pasture Complex," *Bul. Ser. H*, No. 5, 1927. The Welsh Plant Breeding Station, Aberystwyth.

or more of the available green leaf has always been eaten, while less, and generally much less, than half of the sheath and stem has been taken. It is interesting to note that, in proportion as the herbage is old, so does the sheath and stem tend to be more and more neglected. This is particularly noteworthy in the case of Italian Rye-grass standing ungrazed throughout the winter. The burned leaf is eaten to about the same extent as the stem, and, like the stem, is neglected in proportion as it is old.

The Leaves of Grasses in Relation to Shoots.—The shoots of grasses can be conveniently classified as "leaf shoots" and "stem shoots." The former consist only of the blade or lamina of the leaf with the adhering sheath, and contain no true stem. The latter consist of both true stem and leaf (blade and sheath). The majority, or at least a large proportion, of the stem shoots will bear inflorescences, when they may be termed panicle shoots. During the winter and dead season, herbaceous grasses consist wholly or almost wholly of leaf shoots. That is to say, the herbage consists of what are frequently described as "root" leaves when the herbage offering is wholly or almost wholly leaf blades and sheath. When growth commences, stem shoots begin to develop, but the precise date at which such shoots become in evidence varies over a fairly wide margin for the different species. Equally the proportion of stem shoots to leaf shoots at and about heading stage is normally very different for the different species.

Speaking broadly, species which maintain a good development of leaf shoots throughout the growing season provide better summer grazing than species running chiefly to stem shoots. For, as explained in the previous article, root leaves maintain growth over a prolonged period and remain in a juvenile condition (and, therefore, in a nutritive condition) much longer than do stem leaves. The greater capacity for continuous growth of root leaves, as compared with stem leaves, is well exemplified by the fact that the former (if left uncut or ungrazed) attain to much greater length than the latter. Thus the length of fully grown root leaves of Cocksfoot varies from about 21 cm. to 76 cm., the average figure for 361 plants being 51·6 cm. The length of the longest leaves on panicle shoots at flowering time varies from about 14 cm. to 37 cm., the average figure for 94 plants being 25·4 cm.*

* In each case the plants were well spaced, vigorous and two years old, and fully represented all the strains and types of Cocksfoot under study at the Station.

It follows, from the above discussion of the available evidence, that the relation of stem shoot to leaf shoot constitutes a very important economic characteristic of grasses. A number of species are, therefore, compared with reference to this relationship in Table II.

TABLE II.—TO SHOW THE RELATION OF LEAF SHOOTS TO STEM SHOOTS RESPECTIVELY AT PRE-HEADING AND AT HEADING STAGE FOR A NUMBER OF STRAINS AND SPECIES OF GRASSES.

Percentages on Spaced Single Plants.

Species and Strain	April 2–10 Pre-Heading stage		May 9–14 Heading stage	
	Per cent. Leaf Shoots	Per cent. Stem Shoots	Per cent. Leaf Shoots	Per cent. Stem Shoots
Cocksfoot : Commercial ..	91	9	30	70–80*
,, Indigenous ..	100	0	69	31–64*
Perennial Rye-grass—agg. ..	85	15	20	80†
Timothy : Commercial	100	0	2	98*
Tall Oat-grass : Commercial ..	77	23	18	82
,, ,, Indigenous ..	94	6	54	46
Red Fescue : Indigenous ..	98	2	36	64
Hard Fescue : Commercial ..	39	61	25	75‡
Meadow Foxtail—agg. ..	77	23	45	55‡
Sweet Vernal-grass—agg. ..	69	41	9	91‡

The relationship is never an absolute one and depends largely on soil fertility and weather conditions. The figures show, however, that earlier grasses, like Sweet Vernal-grass, Meadow Foxtail, Hard Fescue and French Tall Oat-grass, run to stem shoots much sooner than the later grasses. At heading stage, grasses, like Timothy, French Tall Oat-grass, Hard Fescue and Sweet Vernal-grass, consist predominantly of " stem " shoots, while Perennial Rye-grass and Commercial Cocksfoot are also very prone to run excessively to stem at this stage. It is particularly to be noted that indigenous Tall Oat-grass and indigenous Cocksfoot maintain a higher proportion of leaf shoots than do the non-indigenous strains of the same species, while Meadow Foxtail is another grass which, all through the season, consists largely of leaf shoots.

* End of May, *i.e.*, practically hay stage.

† Considerable variation as to strain. Some strains at hay stage consist of over 90 per cent. stem shoots.

‡ Hay stage.

Contribution of Leaf-Blade to the Different Types of Shoot.—In order, further, to demonstrate the effect on leafiness of the contribution made to herbage by the different types of shoots, the percentage of blade or lamina in "leaf shoots," panicle-bearing stem shoots and non-panicle-bearing stem shoots, at or about heading stage, is shown in Table III for a number of species.

TABLE III.—TO SHOW PERCENTAGE OF LEAF (=BLADE OR LAMINA) IN THE THREE TYPES OF SHOOTS FOR A NUMBER OF GRASSES AT OR ABOUT HEADING STAGE.

Percentages on Spaced Single Plants.

Species	Leaf Shoots*	Non-panicle-bearing stem shoots†‡	Panicle-bearing stem shoots‡
Cocksfoot	70	47	27
Perennial Rye-grass	74	30	21
Red Fescue	75	33	7§
Rough-stalked Meadow-grass ..	63	25	18
Sweet Vernal-grass	63	33	10§
Meadow Foxtail	80	26	6§

The stem shoots of Cocksfoot are more leafy than those of other grasses; in practically all cases, however, the leaf shoots contain at least twice as much leaf as the stem shoots.

Production of Panicle-bearing Shoots under Grazing Conditions.—The grasses vary very considerably in their capacity for throwing up panicle shoots under grazing conditions. This is clearly shown by comparing the number of panicles produced per plant when left to develop hay with the aggregate number produced per plant under a system of monthly pasture cuts. Such a comparison is made in Table IV.

The different species will be seen to vary very considerably in their inherent capacity for the production of inflorescences. Thus Red Fescue and Sweet Vernal-grass are very prolific, while Perennial Rye-grass, Meadow Fescue and Rough-stalked Meadow-grass produce many more inflorescences than Cocksfoot, Timothy, Tall Oat-grass and Meadow Foxtail. All the species have produced less panicles under pasture than under hay conditions. Sweet Vernal-grass and Red Fescue have, however, produced an abundance of inflores-

* The "stem" separation, consisting wholly of sheath.

† Or at all events, inflorescences not exserted.

‡ The "stem" separation, consisting of sheath true stem with inflorescences in the case of the panicle-bearing stem shoots.

§ These early grasses were in a more advanced stage than the others and, therefore, the figures are not directly comparable.

TABLE IV.—TO COMPARE THE NUMBER OF PANICLES PRODUCED PER PLANT UNDER HAY AND PASTURE CONDITIONS RESPECTIVELY. AVERAGE FIGURES PER PLANT BASED ON COUNTS MADE ON SINGLE SPACED PLANTS. THE RANGE OF FLOWERING DATES UNDER PASTURE CONDITIONS IS ALSO SHOWN.

Species	Hay conditions No. per plant	Pasture conditions; under a system of monthly pasture cuts	
		No. per plant	Dates produced
Cocksfoot	55	41	Nearly all June 7
Perennial Rye-grass ..	180	80	Most June 7; few till July 31
Timothy	97	7	All July 31
Tall Oat-grass (French)	37	7	All June 7
Meadow Fescue ..	125	43	Nearly all June 7
Rough-stalked Meadow-grass	187	38	Nearly all June 7
Sweet Vernal-grass ..	262	222	May 8 till August 2
Red Fescue	325	127	June 7 till June 30
Meadow Foxtail ..	59	51	May 8 till June 7

cences under the former conditions. The paucity of panicle production by Timothy and French Tall Oat-grass under pasture is noteworthy, while the considerably greater production by Perennial Rye-grass than by Cocksfoot is equally striking. It will be seen that Cocksfoot, Meadow Foxtail, and Sweet Vernal-grass have been affected least, by repeated cutting, in the matter of relative panicle production. Meadow Foxtail, Red Fescue, Sweet Vernal-grass, and Perennial Rye-grass continue to send up inflorescences over a longer period than do the other grasses.

General Comparison of Leaf to Stem for the Various Species.—The figures in Table V afford material for comparing the average leafiness of some of the chief species of grasses.

Considering the average figures for hay, pasture, and aftermath, it will be seen that Cocksfoot is amongst the most consistently leafy of grasses; it is closely followed by indigenous Timothy. (Unfortunately figures are not available for commercial Timothy as the plants were very badly rusted—commercial Timothy, however, is not nearly as leafy as indigenous.) Highly leafy plants, also, are Meadow Fescue, Tall Fescue, Meadow Foxtail, Red Fescue, and indigenous Tall Oat-grass. Amongst the least leafy are French Tall Oat-grass, French Golden Oat-grass and Crested Dogstail. Perennial Rye-grass and Rough-stalked Meadow-grass take an intermediate position.

TABLE V.—TO COMPARE THE PERCENTAGE LEAF OF THE VARIOUS SPECIES OF GRASSES FOR HAY, AFTERMATH AND PASTURE. AVERAGE FIGURES ARE ALSO GIVEN FOR THE SUM OF HAY, AFTERMATH AND PASTURE, THESE AVERAGES BEING BASED ON ALL THE FIGURES SO FAR COLLECTED AT THE STATION. DATA FOR SINGLE SPACED PLANTS.

Species and strains	General average for sum of hay, aftermath and pasture	Hay	Aftermath	Pasture						
				Autumn of seeding year	March and early April	Pre-hay period	Hay period	Post-hay period	Average of pre-hay, hay, and post-hay periods	Sept.–Oct.
Cocksfoot: Indigenous	66	19	91	87	97	84	39	88	70	94
„ Commercial	61	13	90	87	97	56	34	92	61	95
Perennial Rye-grass: Indigenous	57	10	87	85	92	57	23	57	46	94
„ „ Commercial	50	8	82	88	90	59	19	63	47	95
Timothy: Indigenous*	66	19	97	79	95	86	47	76	69	94
Tall Oat-grass: Indigenous ..	60	15	82	77	96	62	62	69	64	91
„ „ French	35	7	31	65	92	50	26	57	44	80
Meadow Fescue: Commercial ..	64	11	98	86	95	75	19	85	60	94
Tall Fescue: Commercial ..	64	—	—	—	—	—	—	—	—	—
Golden Oat grass: French ..	37	—	—	—	—	—	—	—	—	—
Crested Dogstail—agg. ..	42	—	—	—	—	—	—	—	—	—
Sweet Vernal-grass—agg. ..	63	18	†	77	93	67	28	63	52	90
Red Fescue: Indigenous.. ..	66	17	97	84	90	77	50	93	73	97
Rough-stalked Meadow-grass: Commercial	50	10	72	73	86	69	36	60	55	78
Meadow Foxtail—agg.	60	26	62	82	90	64	38	76	60	90

* Commercial Timothy not available, the plants having been almost completely killed by rust.

† Very variable, depending on date of hay cut. If hay cut early, aftermath will be about 50 per cent., the crop approximating to a second hay cut. If cut late, aftermath will be about 90 per cent.

In view of what has been said as to panicle production, it is interesting to observe that the pasture at about the time of hay harvest is much less leafy, for all species alike, than at other times. Taking the immediately pre-hay, hay and post-hay periods together, Perennial Rye-grass and French Tall Oat-grass show to very poor advantage compared with Cocksfoot and Meadow Foxtail, for example. The figures serve to show why it is that Cocksfoot, under proper management, affords such excellent summer pasturage, while Perennial Rye-grass is often disappointing at this period. The excessive leafiness of after grass is demonstrated by the figures—French Tall Oat-grass alone showing to poor advantage.

The figures for hay vary both in relation to the date of "putting up" for hay and date of cutting, a very few days' difference in cutting having a very considerable effect on percentage leaf. The stemmy nature of Perennial Rye-grass and French Tall Oat-grass hay is, however, indicated. The fact that leaf shoots predominate during the dead season is reflected in the pasture figures for March, which in practically all cases show a percentage of leaf in excess of 90 per cent.

The Effect of Management on Leafiness.—It is well known, of course, that pastures kept well grazed tend to be maintained in a high state of leafiness. This fact has been further demonstrated by the trials conducted at the Plant Breeding Station, where both individual plants and sward plots have been subjected to a system of repeated "pasture cuts."

The statement hereunder, for Cocksfoot, may be regarded as typical of numerous results obtained at the Station, and indicates the magnitude of the effect of close grazing :—

PER CENT. LEAF (= blade or lamina) OF COCKSFOOT.

When cut	three	times	during	the	growing	season . . 49·5 per cent.
,,	seven	,,	,,	,,		. . 67·7 ,,
,,	ten	,,	,,	,,		. . 74·5 ,,
,,	seventeen	,,	,,	,,		. . 81·3 ,,

More recent trials have shown that continued cutting during one season also has the effect of making for a more leafy growth in the next. This would appear to be connected with the effect of such repeated cutting, more particularly upon the panicle-bearing, or at least upon the potential panicle-bearing, shoots.

It has been shown that, even during a current season, the continued removal of inflorescences as they are produced tends to make for greater leafiness. Thus, in the case of a

number of spaced plants representing 14 different species or strains during 1924, one series was kept continually plucked while the other was allowed to grow to normal hay. A little after normal hay harvest, all the inflorescences were carefully picked off the hay plants and both series were then allowed to grow on until August 1, when all the plants were cut and weighed and the produce separated into leaf (lamina) and stem (chiefly sheath, in some cases with a little true stem). In nine species or strains out of the 14*, the plucked series gave the highest percentage of leaf, the average figures for all the species plants involved being :—

Plucked plants	63·5 per cent. leaf (= lamina).
Non-plucked plants ..	57·0 ,, ,,

These figures would appear to be in support of the contention that on sheep pastures, for example, it is a sound practice to run the mowers over the fields at or about the time of hay harvest—a practice which not only removes benty and drying material, but which, probably, also actually encourages the development of a more leafy herbage.

The effect of one season's treatment on potential panicle development during the next is, however, altogether more marked. In the case of the 14 species and strains subjected to the plucking treatment above referred to, without exception, a system of 11 pasture cuts compared with a hay and aftermath cut in 1925 showed in 1926 a substantial reduction of panicle tillers. The comparison hereunder shows typical examples.

TABLE VI.—NUMBER OF PANICLE TILLERS PER PLANT AT HAY TIME WHEN SUBJECTED TO PASTURE AND HAY CONDITIONS RESPECTIVELY DURING THE PREVIOUS YEAR.

	After 11 pasture cuts	After a hay and aftermath cut
Cocksfoot : Indigenous	24·5	53·7
,, Commercial	16·8	52·3
Tall Oat-grass : Indigenous ..	35·6	107·1
,, ,, Commercial ..	5·5	41·1
Perennial Rye-grass : Commercial	43·0	105·7
Meadow Fescue	13·0	60·3

Field plots kept cut from year to year on a pasture system compared with a hay system, have also shown that, on the

* The four lots which gave higher percentages of leaf on the non-plucked plants were the two strains of Perennial Rye grass (the difference in the commercial strain being only very slightly in favour of the non-plucked) and the highly leafy indigenous Cocksfoot, and indigenous Meadow Foxtail.

former plots, the tillers tend to be smaller than on the latter —while pasture following pasture tends also to be distinguished, from pasture following hay, by tillers of a smaller size. The facts, therefore, suggest that repeated cutting or heavy grazing tends in the direction of inhibiting the formation of panicle (the larger) tillers both during and subsequent to the season of heavy grazing or cutting and chiefly on this account makes for a more leafy herbage.

It is, however, at least probable that a failure to produce potential panicle tillers in normal amount denotes a loss of vigour on the part of the plants concerned. This is an aspect of repeated cutting or of heavy grazing that must be given serious consideration in relation to systems of management designed to keep pastures always in a state of super-leafiness, super-palatability and super-nutritiveness. The matter will, however, more conveniently be dealt with from this point of view in the next article, which will be concerned chiefly with tiller production.

It will have been appreciated that the evidence discussed in this article has been based on single plant data. Trials now in progress on field plots, however, show that the behaviour of the majority of the plants is qualitatively, if not actually quantitatively, similar whether grown as single plants or in sward.

Thanks are due to Miss Grice, formerly on the staff of the Station, who was responsible for the conduct of the trials upon the evidence of which this article has been chiefly based.

* * * * * *

VIRUS DISEASES OF POTATOES AND THE RAISING OF SEED POTATOES IN THE IRISH FREE STATE

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IN marked contrast with bygone days, when a change of seed was seldom thought of, much less adopted as a regular procedure, the experience of the last few decades has developed in potato growers generally a belief that deterioration in varieties and stocks of potatoes is due to senile decay; and that, to ensure an average crop, it is necessary always to plant seed which has been grown in higher latitudes. The rapid loss of vigour and consequent loss of yield in "home-saved," sometimes called "once-grown" or "twice-grown," seed is popularly explained as a

penalty incurred through present-day specialization in potato production ; but this supposition is not supported by scientific opinion.

Research into Virus Diseases of Potatoes.—Research on the problem has been carried out in several countries : by Dr. Quanjer in Holland, various workers in America, a few in this country, and, notably, by Dr. Paul A. Murphy and his assistant, Mr. R. McKay, at the Albert Agricultural College, Glasnevin, near Dublin. These investigations show conclusively that deterioration in potatoes is mainly, probably entirely, due to the presence of what are called virus diseases : the term " virus " being used because no organism has yet been isolated ; and " disease," because all the symptoms and attendant results can be produced in otherwise healthy stock by natural infection and artificial inoculation.

In July last the writer visited the experimental station at Glasnevin and had the privilege of studying the results of several years' research work carried out there by Dr. Murphy, which go to confirm and supplement the results obtained by other investigators ; also of visiting various places in the Irish Free State, where the practical application of the basic principles deduced from these researches are being commendably applied in the raising of seed potatoes free from virus diseases.

Some of Dr. Murphy's early researches were carried out with stocks regarded at the time as virus free, but which his subsequent investigations showed to be infected—a discovery that necessitated a revision of some years of work and a fresh interpretation of the results obtained through it. That potato stocks intended for experimental work must be free from any form of virus disease was thus recognized as essential ; and no plants are now used until they have been proved by experiment to be healthy.

Testing for Presence of Virus Diseases.—This is determined by growing in a pot a virus-free tuber of such a variety as President or Arran Victory, which, when infected, are good indicators of any and every form of virus disease, the growing plant being carefully protected from external sources of accidental infection. When the haulm of such a plant is about half-grown, the terminal 2 in. is removed, and in its place is grafted the terminal 2 in. of the haulm of the plant to be tested. If any virus is present in this scion, the first leaf which subsequently arises on the stock below the union will show in marked degree the slightest trace of its presence.

Another successful method is that of tuber grafting. From the tuber to be tested a core of about 13 mm. diameter, without an eye, is removed by means of a cork borer, and inserted into an opening previously made in a healthy tuber by the removal of a similar core. The latter healthy core may contain an eye and be used as a control. This and the grafted tuber are then planted and grown under insect-proof conditions. If any virus were present in the implanted core, its effects will appear as disease symptoms in the tuber shoot; while the growth of a healthy plant from the control core is proof that the tuber employed in the test was not itself diseased.

Classes of Virus Diseases in Potatoes.—The results of the work carried out on these lines go to show, as was already known, that there are at least two well-defined classes of virus diseases, *viz.*, leaf roll and mosaic, and that the two classes are not interchangeable, *i.e.*, the virus producing leaf roll will not produce mosaic, and *vice versa*. Further, different types of mosaic have been recognized and given such names as Aucuba mosaic, rugose mosaic, crinkle, etc., and it is thought that the virus producing each type is specific for that type. These virus diseases, too, may exist together in one and the same plant; and when leaf roll and one or more types of mosaic are present in one plant, we get that characteristic stunted-looking potato plant described as "curly dwarf." The successful identification of the various kinds of mosaic diseases is the special business of the expert, and it is hardly likely that they could ever be identified by the casual observer; but when once familiar with the appearance of the healthy plant, the diseased plant can easily be seen and removed from an otherwise healthy stock.

Leaf Roll.—Leaf roll is by far the most serious of the virus diseases, but fortunately it is not as prevalent as mosaic. No potato variety has been shown to be immune from leaf roll; neither does it appear so far that strongly resistant varieties occur commonly. The transmission of the leaf roll virus to any healthy plant produces nearly the same disastrous result whatever the variety may be, and thus the reduction in yield per acre is closely correlated with the number of plants infected. With a severely infected crop the yield per acre is very low indeed, and when once a plant is infected there is no recovery.

Mosaic.—The case is somewhat analogous with mosaic. Some varieties are tolerant of it and others are not. The

meaning here of "tolerant" is that some varieties of potatoes show mosaic, but the vigour and yield are not very much reduced however much mosaic is present; and, as mosaic is very prevalent, there are certain tolerant varieties of potatoes which, outside experimental grounds, are not known entirely free from it. British Queen and Up-to-Date are cases in point. Both these varieties are well known and have been grown commercially for years, but recently they have lost prestige because (1) they are not immune from wart disease; (2) both are susceptible to and suffer greatly from blight, but neither variety is worn out. They do crop well even if mosaic is present, providing blight, wart disease, and leaf roll are absent. Varieties intolerant of the disease are most markedly affected in appearance and in yield by the virus of mosaic; and amongst such varieties may be mentioned Irish Chieftain.

Thus there is an explanation for the transient existence of many varieties of potatoes, which proved very promising when on trial, but which have been disappointing when grown commercially; and it is now possible to foretell with some degree of accuracy whether any new variety of potato is likely to become a popular, commercial, and useful potato by its tolerance or otherwise—not its susceptibility, for that bears no relation to tolerance—of mosaic. At present a new variety is tested for its immunity from wart disease, as such immunity is highly desirable; but it is of equal importance to test new varieties for their tolerance of mosaic, which is far more widespread than wart disease, and which has in intolerant varieties a more immediate and disastrous effect on the yield.

Mature and Immature "Seed."—It has been the custom in England to say that the increased vigour and greater crops resulting from Scotch "seed," compared with once- or twice-grown English "seed" of the same variety, lay in the fact (assumed or otherwise) that potato crops grown in Scotland did not mature as early or as fully as those grown in England; and thus the virtue of Scotch "seed" lay in its immaturity or its comparative lateness in maturing. Very many experiments have been carried out in England which in the aggregate proved that English "seed" obtained from crops lifted while green yielded better crops than the equivalent "seed" obtained from crops which had been permitted to mature; and growers in this country have been advised from time to time

to lift crops when green if intended mainly for "seed," and so secure the equivalent of Scotch "seed."

Dr. Murphy has clearly shown in one experiment that, if "seed" potatoes are free from virus diseases, very immature "seed" will not produce either as early or as large a crop as identical "seed" obtained from matured crops. If, however, virus diseases are present in one crop and not in the other, the matured "seed" obtained from the virus-infected plants will yield a smaller crop than the matured "seed" obtained from the virus-free plants, other factors being equal. Further, if the infected crop has resulted, not from infected "seed," but from infection during the growing season, then immature "seed" obtained from such a crop will contain less virus than the "seed" from the matured crop, for the virus in the haulms and foliage will not have had the same opportunity of reaching the tubers; and the immature "seed" in this case is most likely to produce an earlier and larger crop than the matured "seed." Thus, maturity, as such, has no bearing in the matter; it is simply a question of the presence or absence of virus diseases in the "seed."

Indeed, the summation of many years' research work on virus diseases points to the fact that the main determinants of productivity of "seed" potatoes are very closely proportional to the amount of serious virus diseases present in the planted "seed," and that the place of origin in itself is no reliable guarantee of health and productivity. As the diseases are spread by insects, the factors governing the production of healthy "seed" in any district are (1) the extent to which potatoes are grown in the district; (2) the introduction of diseased "seed"; (3) the rotation; and (4) the presence of "volunteer" plants. Where potato growing is congested the area may become, and often is, virus infected. It is no coincidence that the "seed" from the Lowlands of Scotland, from Ayrshire, yields little if any better crop in Lincolnshire than does Lincolnshire "once-grown" (Class I) "seed," while the best quality of "seed" is obtained from those areas in Scotland where potato growing is not so congested, and where the grower has at least a four years' rotation of crops.

"Seed" Potatoes from the Irish Free State.—It is these facts which the Department of Lands and Agriculture of the Irish Free State are endeavouring to put into practice in order to produce healthy and productive "seed." Nowhere in that country, except perhaps in the neighbourhood of towns, are potatoes grown to the same degree, taking area for area, as

in South Lincolnshire, and the crops are remarkably free from virus diseases. In such uncongested areas, throughout the Irish Free State, certain varieties of Scotch "seed" potatoes have been introduced with the object of raising such "seed." In one case, as much as 80 per cent. of the growing plants were removed because of "degeneration diseases." In other cases the removal of 50 per cent. was common, while in yet others a nucleus stock was selected from the stocks raised by the above treatment, every plant of which was proved to be healthy by grafting experiments; and these nucleus stocks were visited as they were being propagated in isolation, and finally the "seed" planted in a suitable area.

The minimum treatment given to these "seed" crops is a drastic rogueing out of all and every sign of "degeneration diseases," and rogueing for blackleg, as well as for purity, by competent pathologists and inspectors. These "seed" crops, about one or two acres each in area, are very strong, very vigorous, and true to type. The "seed" from such crops which is for sale is taken to a common store, and the Irish Free State employs inspectors whose business it is to see that one and the same variety is put together, and while being bagged for sale the inspectors reject any unsound tubers and seal the bags with the Free State seal. In this work the Irish Free State has not forgotten wart disease. The Order is very exacting and ruthlessly applied. No "seed" potatoes are permitted to leave the scheduled areas. When potatoes are being moved, inspectors are posted like guards to prevent their exit. There is every reason, then, to believe that if English potato growers obtain "seed" potatoes from the Irish Free State, in bags bearing the Free State seal, satisfactory crops will result, as has been the case with samples of this Irish "seed" grown in Essex in 1925.

In these stocks, the Free State growers, under the guidance of the Department of Lands and Agriculture, have gone farther than the Scotch "seed" potato grower in removing "degeneration diseases," the disastrous effects of which can only be judged by comparing the vigour and health of virus-free plants with virus-diseased plants. Up to the present, however, there is not an unlimited amount of this "seed" available; and it will demand the continuance of the present measures, with considerable determination and fixity of purpose, to ensure the fullest measure of success for this work. The advent of another competitor in the "seed" potato trade ought to be of advantage to the English grower. Nor is that all, for as the production of healthy "seed" potatoes is not directly affected by

such climatic variations as are normally experienced in the British Isles, it may be carried on in suitable parts of England where facilities exist similar to those in Ireland or Scotland.

In conclusion, the writer desires to acknowledge his indebtedness to Dr. Murphy for his kindness in explaining his experiments, and to Mr. W. D. Davidson, of the Irish Department of Lands and Agriculture, for the excellent arrangements made for the tour to see the numerous potato plots.

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MARKETING OF EGGS ACTS, 1924 AND 1926 (NORTHERN IRELAND)

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THE Department of Agriculture for Ireland was established in 1900, and during the ensuing 21 years devoted considerable attention to the marketing in Great Britain of Irish agricultural produce, *viz.*, butter, eggs, potatoes, etc.

In particular, marketing of eggs received special consideration, every effort being made to induce exporters voluntarily to have their eggs properly packed, in suitable boxes, in a fresh and clean condition. The Department's work undoubtedly produced some improvement in the conduct of the Irish egg trade, but this disappeared in 1916, when prices were controlled by regulations made under D.O.R.A. The effect of these regulations was that people became quite careless and indifferent as to the appearance of their eggs and the manner in which they were packed for market. Indeed, there was no inducement for them to do otherwise, since the controlled price disregarded quality to such an extent that practically the same price could be obtained for all classes of eggs—good, bad and indifferent. The regulations were withdrawn after 1918, and those foreign countries which had before the War exported eggs to Great Britain realized that the then unsatisfactory condition of the home trade afforded them a unique opportunity of recapturing the United Kingdom markets. By the adoption of improved methods in the grading and packing of their eggs the countries

in question succeeded in securing a very large volume of the trade—Irish eggs being relegated to a very inferior position. This state of affairs continued up to 1921, when a separate Government for the six northern counties was established.

The Ministry of Agriculture for Northern Ireland began to function on January 1, 1922, at a time when Irish eggs had practically disappeared from the London market, and occupied only a third or fourth place on the British market generally as compared with the produce of competing foreign countries and the Dominions. One of the Ministry's earliest actions was to investigate the conditions of the Northern Ireland egg trade, and in this connexion it sent its Marketing Inspector to London to interview a number of the leading wholesale egg merchants at Smithfield Market. He was informed that no Irish eggs had been sold in London since 1916–17, whereas before the War Irish eggs held a good position on that market. When asked the reason why Irish eggs were not then bought by them, these merchants stated that their experience was that they could rely on the best foreign eggs because they were well packed, graded and tested, and true to guarantee or invoice, whereas Irish eggs had become so unsatisfactory and so unsuitable in respect of quality, packing and grading that they had to be unpacked, re-sorted, tested and graded before they could be sent out to retail customers—a process which entailed an unremunerative outlay. He also ascertained that the demand for Irish eggs in other English cities was falling off, and that most Irish egg merchants were having considerable difficulty in disposing of their shipments.

Realizing that the attempt to improve the industry by voluntary effort was ineffective, the Ministry decided that legislation was necessary, and an Advisory Committee, representing all interests—*viz.*, producers, collectors, retail merchants and wholesale merchants or shippers—was accordingly appointed by the Ministry.

This Committee met on a number of occasions to discuss the matter, and eventually, with the assistance of the Ministry's officials, a Bill was drafted. Before presentation to Parliament the Bill so drafted was submitted to the Farmers' Union, co-operative societies and egg merchants' associations, and in the end an agreed Bill was introduced and became law in May, 1924.

Owing to certain difficulties arising from the provisions of the Government of Ireland Act, 1920, the Marketing of Eggs Act was much more complicated than otherwise would have

been necessary, and a very much wider field had to be covered. As these difficulties, however, are disappearing, consequent on the settlement of the boundary question between Northern Ireland and the Irish Free State, and of the matter of the Council Services, an amending Bill was presented to the Parliament of Northern Ireland in October and became law in November, 1926.

The original Act became operative on January 1, 1925, and its chief points are as follows :—

A. All wholesale dealers in eggs must have a licence.

The Ministry shall grant a licence to carry on business in Northern Ireland as a wholesale dealer in eggs to any person applying for such a licence who complies, or undertakes to comply, with such conditions in relation to the preparation for sale and the consignment of eggs as may be prescribed from time to time by the Ministry with respect to any class of such business in order to secure—

(*a*) the proper testing, grading and packing of such eggs, and their freshness and fitness for the food of man ; and

(*b*) compliance with the requirements of this Act relating to any such eggs.

By " wholesale dealer " is meant any person who carries on the business of purchasing eggs for re-sale *otherwise than by retail.* Therefore, wholesale dealers include : (*a*) merchants who ship or export eggs ; (*b*) local dealers in small towns or villages who sell otherwise than by retail ; (*c*) those who buy eggs throughout the country, that is, who gather or collect eggs from the producers.

The extent of the task of getting all these classes to apply for licences will be realized when it is mentioned that during the first year of the operation of the Act no fewer than 1,734 licences were issued. A licence—the fee charged is 20s.—remains in force until suspended or revoked by the Ministry, and up to the present the Ministry has suspended only 25 licences for periods varying from one to six months.

Licences were given automatically to all wholesale merchants who made formal application and gave an undertaking that, if their premises were not suitable or did not comply with the Regulations, they would put them in order on being given a reasonable time to do so. By adopting this course, which did not inconvenience or disturb the trade, the Ministry was able to induce practically all the wholesale merchants in Northern Ireland to take out licences during the first year. If the Ministry had first insisted upon premises being put in order

before licences were granted, considerable trade difficulties would have been created, and the Ministry could not have received that loyal co-operation which the trade has given it in carrying out the provisions of the Act.

B. Premises where eggs are *preserved*, *cold-stored* or *pickled* must be registered :—

(*a*) The owners of such registered premises must keep records and furnish to the Ministry returns showing the delivery, dispatch and ownership of eggs dealt with on the registered premises. These records must be open to inspection by the Ministry's officers.

(*b*) Every package, whether open or closed, which contains any such eggs must be branded with the words " Preserved Eggs," " Cold-stored Eggs " or " Pickled Eggs," as the case requires.

(*c*) If any such eggs are exposed for *sale by retail* there must be attached to, or exhibited with, each lot thereof so exposed, in such manner as to be clearly visible to the purchaser, a label marked, in printed capital block letters not less than one and a half inches square, with the words " Preserved Eggs," " Cold-stored Eggs " or " Pickled Eggs," as the case requires.

C. Certain market authorities must provide covered accommodation for packing :—

The market authority of every market, in which tolls are for the time being authorized to be taken, and actually are taken, in respect of eggs, shall provide and maintain such covered sheds or other accommodation for the packing of eggs brought for sale at the market as the Ministry considers suitable.

If the market authority fails to comply it is debarred from charging toll in respect of eggs brought for sale at that market.

D. The Act brings into force in every urban and rural district in Northern Ireland, as regards eggs, certain permissive provisions of the Public Health Acts, 1870 and 1890, in relation to articles intended for the food of man. This enables a local authority to prosecute any person who sells or attempts to sell unsound eggs, and already 50 local authorities, out of a total of 64, have appointed trained inspectors to see that these provisions of the Act are carried out.

The Regulations made under the 1924 Act prescribe the kinds, sizes, etc., of boxes to be used, as well as the quality of timber and the material for packing.

A question arose as to whether either straw or wood-wool should be used exclusively for packing. Some merchants advocated home-grown straw, while others urged that wood-wool only should be permitted, since this was the material invariably used by our foreign competitors. Ultimately the Ministry recommended the use of wood-wool, but agreed that wheat or oat straw could be used provided it was thoroughly dry, clean and sound.

Another point which caused some little difficulty was whether home-grown or foreign timber should be used for making cases. In rural districts the manufacture of egg cases is a local industry, both seasoned and unseasoned home timber of all kinds being used for this purpose. Most of the hardwood timbers are unsuitable. It has been found that boxes made of unseasoned oak weighed 70 lb. and boxes made of unseasoned beech weighed 60 lb., while boxes of well-seasoned home-grown spruce weighed 33 lb. only. The Ministry in its Regulations prescribes that home-grown timber may be used for egg cases, provided that the wood is well-seasoned, dry, clean and free from bark. The same conditions apply to foreign timber.

E. Eggs Must be Graded.—The old system was to sort eggs according to different sizes. They were divided into *smalls*, those below 14 lb. per great hundred; *selected*, those not less than 14 lb., with an average weight of not less than 15 lb., per great hundred; and *extra selected*, for eggs not less than 15 lb., with an average weight of not less than 16 lb., per great hundred. It was, however, customary, if a case of selected or extra selected exceeded the nominal weight, to adjust the weight by taking out some of the large eggs and substituting small eggs: so that a case of "selected" eggs could contain 14 lb., 15 lb., 16 lb., and even 17 lb. eggs. This, however, was merely "sorting," not "grading," but it was popular amongst certain merchants in Great Britain, since it enabled them to re-grade these eggs into 14 lb., 15 lb., 16 lb. and 17 lb., and thereby to obtain a handsome profit on the higher grades.

It transpired that on an average the percentages of the different grades of eggs passing through the hands of Northern Ireland egg merchants were as follows:—

70 per cent.	15½ lb. grade
20 to 25 per cent.	below 15½ lb.
5 per cent. (approximately)	17 lb. and over.
2 per cent. (,,)	smalls.

Accordingly, as it was considered desirable that uniform standard grades with guaranteed weights should be provided, the Ministry, with the approval of the trade, decided to prescribe the following grades in the Regulations made by it under the Act:—

Grade 18 lb.—For eggs of uniform size weighing 18 lb. per 120. No 12 eggs in any 120 shall weigh less than 28 oz.

Grade 17 lb.—For eggs of uniform size weighing 17 lb. per 120. No 12 eggs in any 120 shall weigh less than 26½ oz.

Grade 15½ lb.—For eggs of uniform size weighing 15½ lb. per 120. No 12 eggs in any 120 shall weigh less than 24 oz.

Grade 14 lb.—For eggs of uniform size weighing 14 lb. per 120. No 12 eggs in any 120 shall weigh less than 21½ oz.

Grade "Smalls."—For eggs too small for inclusion in the 14 lb. grade and weighing less than 21½ oz. per dozen.

The principal merits of this system are that graded eggs carry better; that each grade represents a definite guaranteed weight per 1 hhd. (10 doz.); and that the eggs in each grade are of uniform size.

The other system of offering "selected" eggs, to which reference has been made, consists in merely selecting the eggs and guaranteeing the *average* weight in each selection. This method, however, does not provide uniformity in size, and for the better class trade, for which uniformity is demanded, necessitates rehandling and proper grading by the purchaser.

The first of these grades was included at the request of the representatives of certain districts where it is claimed that a high proportion of very large eggs was produced. As the Ministry does not encourage the dispatch of the last grade ("smalls") to markets in Great Britain, there are in effect only three main grades for export, *viz.*, 17 lb., 15½ lb., and 14 lb.

Each egg in a case must approximate closely to the general average of the eggs in that case, and the top layer must be fairly representative of the bulk in size, colour and appearance. Apart from the special provisions for preserved, cold-stored and pickled eggs, only "fresh" or "new-laid" eggs may be included, and to this end it is prescribed that, amongst other characteristics which must be present in a "fresh" or "new-laid" egg on being tested, the air space may not exceed a quarter-inch.

The Regulations also require that an egg shall be rejected on test if:—

(*a*) It is opaque or black.

(*b*) The white is dull, cloudy or streaky, or the yolk cannot be distinguished—this condition usually indicates a broken or spread yolk, and the egg is known as "spent."

(*c*) The yolk is distinctly darkened in appearance, flattened in shape and floating near to the shell.

(*d*) The yolk is anywhere in contact with the shell, under which conditions the egg is known as "sided." Contact is denoted by a spot on the inner side of the shell, and also by the fact that, when the egg is turned quickly, it is observed that the yolk adheres to the shell.

(*e*) It contains blood spots or has dark or mould spots under the shell.

Their experience of the working of the 1924 Act impelled the principal egg exporters in Northern Ireland early in the present year to make representations to the Ministry as to the

desirability of bringing in an amending Bill to deal more particularly with :—

(1) The compulsory purchase of eggs by weight ;
(2) The prohibition of the sale of dirty, soiled, stale or unsound eggs by producers ; and
(3) The application to persons purchasing eggs for re-sale by retail of the same conditions as apply to wholesale merchants.

Practically the whole of the trade pressed the Ministry to make compulsory the purchase of eggs by weight, which it was contended would be fairer to both producer and exporter than the customary sale by count. It was pointed out that one of the chief difficulties of the trade was the disposal of the small egg (14 lb. or less per great hundred of 120 eggs), inasmuch as the egg in greatest demand in Great Britain is (as a minimum) the 2 oz. egg or 15 lb. per great hundred.

In certain districts of Northern Ireland eggs are purchased by weight from the producer instead of, as elsewhere, by the dozen or by count. When purchased by the latter method practically the same price is given for large eggs as for small eggs, so that there is no inducement for poultry keepers to produce large eggs—in fact, it has had the other effect, *viz.*, to produce quantity at the expense of size. Producers, therefore, sold their small eggs and used the large ones at home.

In one district where eggs have been purchased by weight for many years it was observed that in the beginning the number of small eggs offered for sale was very high, but in a short time this grade represented only 17½ per cent. of the eggs offered for sale—more than 82 per cent. being 15½ lb. and over per long hundred. The average weight per 120 of the eggs purchased by one of the principal wholesale dealers operating in the district in question increased until it was 16¼ lb. from one year's end to another. Producers in that district found that it paid them to sell the large eggs, and they increased the size of the eggs for sale by consuming the small eggs at home and by paying more attention to breeding poultry which lay large eggs.

If eggs are bought by weight, breeders of poultry will pay more attention to the production of large eggs, and laying competitions will have far greater effect than they can possibly have at present. So long as eggs are purchased by count, laying competitions can have little influence in encouraging the production of larger sized eggs.

The 1924 Act applied to wholesale merchants only, producers and retail merchants being unaffected by it, except as regards

preserved eggs. The trade, however, put forward a claim, which the Ministry considered reasonable, that the Regulations for wholesalers as laid down under the original Act should apply also—so far as appropriate—to producers and retailers, because, unless poultry keepers were compelled to market only clean, fresh eggs, it would not be possible for wholesale merchants to comply with the Regulations. Further, if retail merchants were permitted to purchase in the same market as the wholesale merchants and not be bound by the same Regulations, a considerable dislocation of trade would result, and wholesale merchants would inevitably lose many of their regular suppliers.

The Ministry gave very careful consideration to these several representations, and, having conferred with its Advisory Committee and consulted the agricultural bodies referred to above, decided to take action on the lines suggested. The necessary provisions were accordingly inserted in the amending Bill which has just become law.

The results achieved in the short period that has elapsed since the Act of 1924 came into operation have far exceeded the Ministry's anticipations. It is a fact that a most gratifying improvement in the methods of marketing Northern Ireland eggs generally has been effected. The best graded eggs from our small area are now securing across the Channel prices equal to those for foreign eggs of the best quality, and in some instances, indeed, they are quoted higher. It is the intention of the Ministry not to relax its efforts until the desired object has been attained of placing Northern Ireland eggs in the premier position on the markets of Great Britain.

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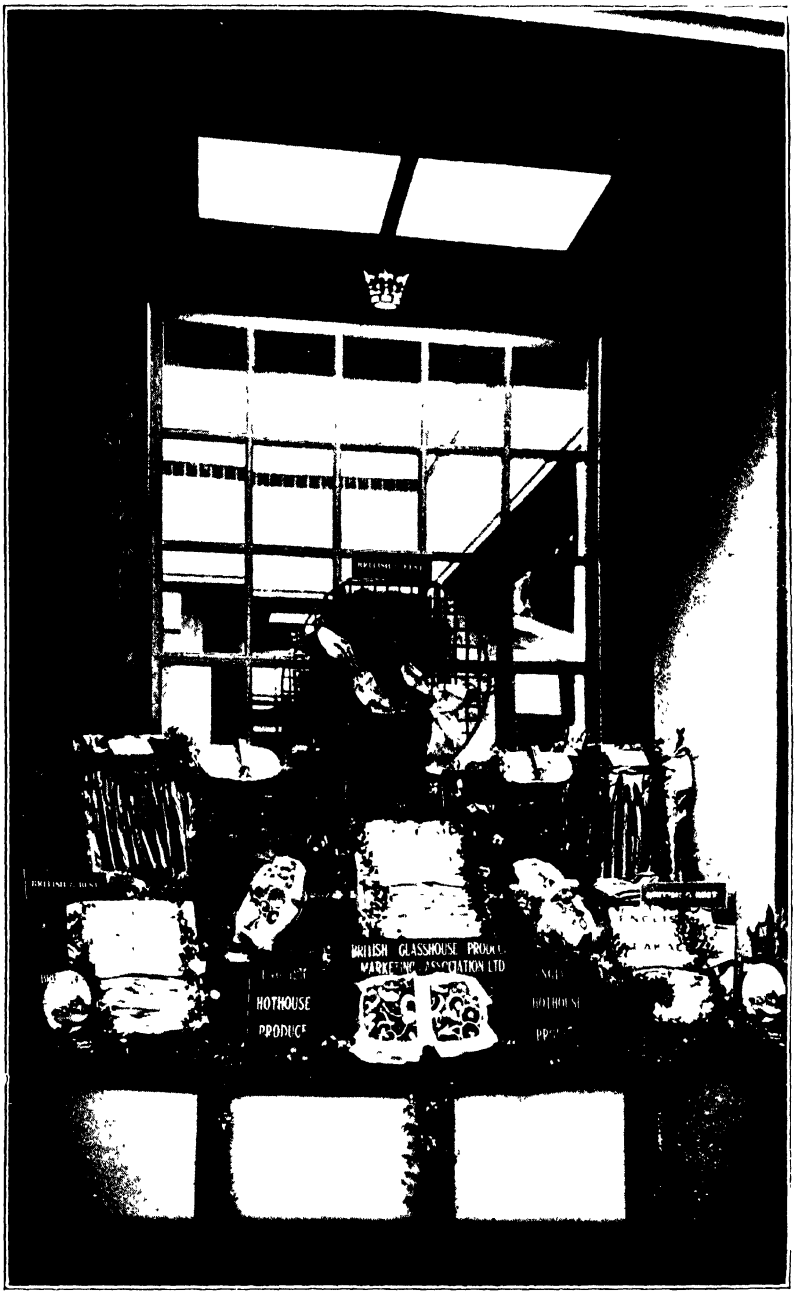
DISPLAYS OF HOME PRODUCE

British Industries Fair.—A preliminary note on the display of home-produced foodstuffs at the British Industries Fair appeared in this JOURNAL last month (p. 1074). Now that the Fair has been held, a more detailed account may prove of interest. The Fair as a whole has been more successful than in any previous year. Nearly 100,000 people visited it, of whom practically three-fourths were trade buyers from all parts of the world.

The section which, perhaps, attracted most attention was that organized under the auspices of the Empire Marketing Board, the design and lay-out of which were entrusted to the



[*Photo Studi*

Display of English hot-house produce; arranged by the British Glasshouse Produce Marketing Association at the British Industries Fair.

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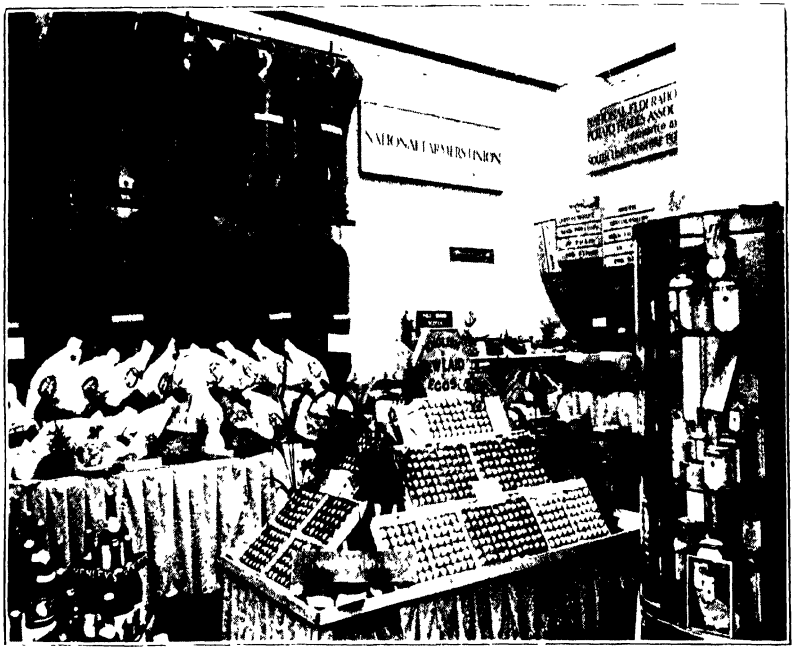
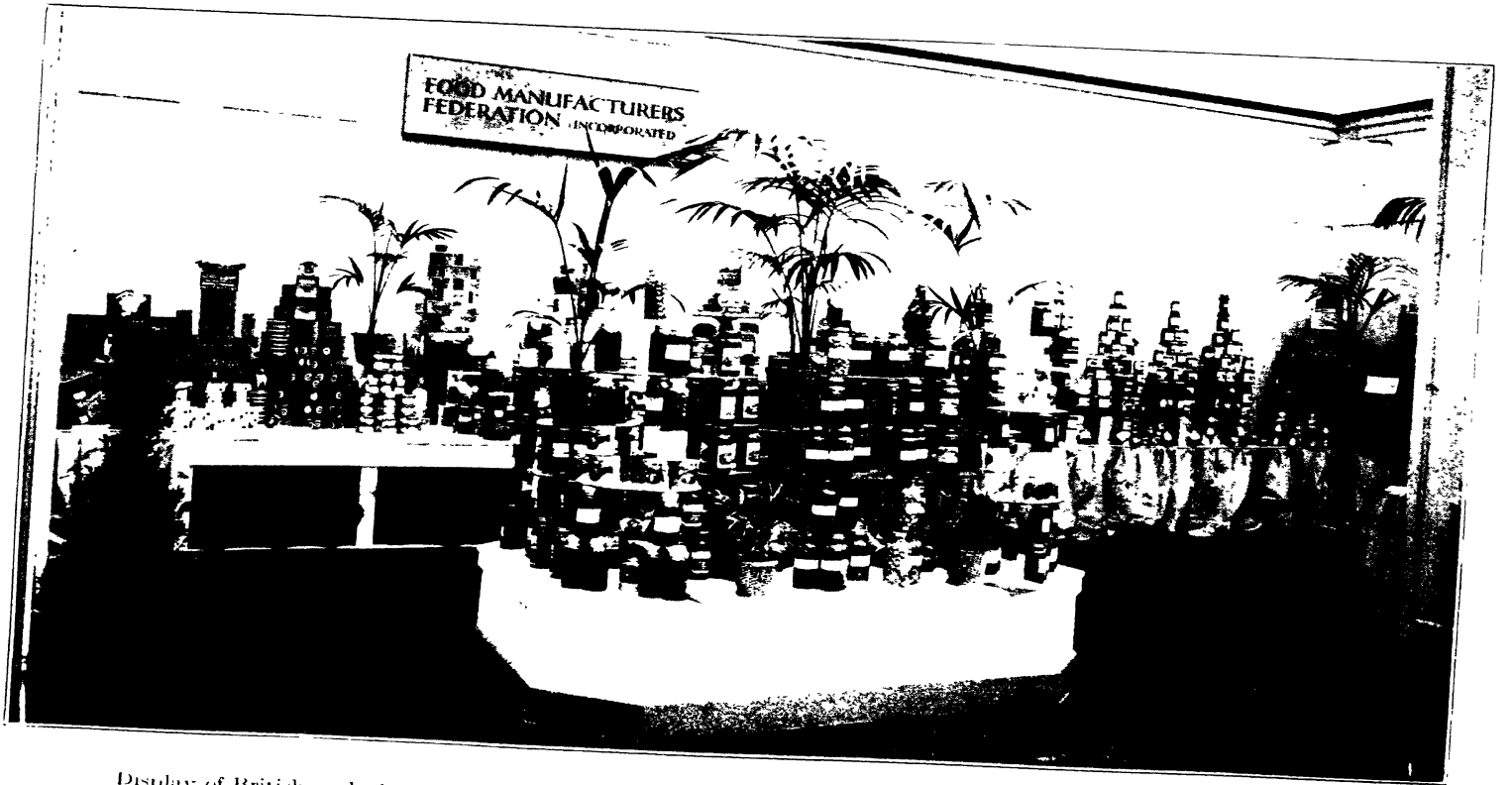


Display of produce; arranged by the National Farmers' Union at the British Industries Fair.



Display of British packed goods; arranged by the Food Manufacturers' Federation at the British Industries F... [*Photo Swaine*

[*Photo : Sims*

Selection of potato dishes, as demonstrated at the Ideal Home Exhibition.

Department of Overseas Trade. All concerned are to be congratulated on the excellence and dignified arrangement of this symbol of Empire trade. No higher compliment could be paid than to say that it was worthy of the Empire it represented.

A spacious court of honour with a statue of St. George as centrepiece, and surrounded by a frieze depicting historical subjects, formed the centre of the section, whence wide avenues, 100 feet long, ran out on each side. Bordering the avenues, were stands in which all the Dominions and most of the Colonies, as well as India and the Mother Country, staged displays of their products.

The Great Britain section occupied a quarter of the available space and was divided into three bays. As the exhibits in this section were confined to foodstuffs, the Ministry was invited to make the general arrangements. All the produce shown in this section was of English, Welsh or Scottish origin. The first bay was devoted to a number of agricultural products arranged by the National Farmers' Union, with the assistance of other organizations, and, where necessary, of representative firms. On each side of this bay, facing the avenue, was a decorative window, in one of which the British Glasshouse Produce Marketing Association staged an attractive display of early produce, including cucumbers, rhubarb, mushrooms, seakale, grapes and flowers. These came from the Lea Valley and Worthing districts. In the other window were small items of dairy produce, such as crustless cheese in cartons, dried milk, etc. The remainder of the dairy produce was arranged inside the stand, and comprised cheeses of all kinds, including Cheddar, Cheshire, Wensleydale and Stilton, as well as further samples of the small cartons of processed cheese which are at present so popular. Home buyers were particularly interested in the produce of individual farmers.

The Western Curers' Association, the Midland Curers and the St. Edmondsbury Co-operative Bacon Factory were responsible for a representative display of home-cured bacon and hams, which greatly interested both British and foreign buyers. The exhibit of seed and ware potatoes from Lincolnshire and Scotland also attracted considerable attention. This was arranged by the National Federation of Fruit and Potato Trades' Associations, and resulted in a considerable number of orders and inquiries, both for the home market and for export. Another exhibit which, although small, was significant, was that arranged by the British Sugar Beet Society. Specimens

of sugar from the various British beet factories were shown, also samples of molasses and dried pulp.

In the centre of the stand was a pyramid display of bottled cider staged by the National Association of Cider Makers. On each side of this was a striking exhibit of graded eggs put up by the Wiltshire Egg Producers, Ltd., and the West of England Egg and Poultry Merchants' Association respectively. Here much business was done, which fully justified the action of the National Farmers' Union in laying down the rule that only graded eggs should be shown. Considerable interest was shown in the system adopted by Wiltshire Egg Producers, whereby each egg is stamped with a trade-mark, which carries with it a guarantee that the egg when sold to the consumer is not more than 14 days old. This firm delivers the eggs to the retailer within four days of laying, and the retailer buys on condition that he will not sell the eggs after 10 days from the date of receipt. The firm has means of checking that this condition is observed.

The next bay contained a representative display of British canned fruit staged by the National Food Canning Council. This is an industry which has recently shown promising activity and, although by far the greater part of the canned fruit consumed in this country is still imported, it is satisfactory to see that British canned fruit more than holds its own so far as quality and variety are concerned. Practically every fruit grown in this country can now be obtained in tins all the year round. Many inquiries were made by overseas buyers.

The third bay was devoted to a representative display of packed foodstuffs arranged by the Food Manufacturers' Federation. This covered such diverse subjects as bottled and canned fruits and vegetables, meat and fish in tins and jars, cereal products in packets and tins, preserves, jellies, pickles, biscuits and beverages. Here again it was gratifying to see that the Mother Country is abreast of developments in modern methods of processing and packing foodstuffs. Many inquiries both for home and export markets were received.

Ideal Home Exhibition.—The general arrangements for Empire products were similar to those at the British Industries Fair, except that home-grown produce, through the Ministry, was allotted more of the available space. Unfortunately the National Farmers' Union was not able to participate in this

Exhibition, but arrangements were made by the Ministry for the Food Manufacturers' Federation, the National Food Canning Council, the British Glasshouse Produce Marketing Association and the National Cider Makers' Association to stage effective displays. An exhibit of British bacon and hams was included with the products staged by the Food Manufacturers' Federation. In addition, the National Milk Publicity Council arranged a good display of dairy produce, including cheese of all kinds, as well as fresh, condensed and dried milk.

The demonstrations of cooking with Empire produce, which were given continuously in four fully equipped kitchens, proved an attractive feature. Home produce received adequate attention in these demonstrations, a large quantity of material for this purpose having been supplied gratis by the Food Manufacturers' Federation, the National Association of British and Irish Millers, the National Milk Publicity Council, and the National Federation of Fruit and Potato Trades Associations. In addition, and with a view to stimulating the consumption of potatoes, arrangements were made by the Ministry for the chef of the First Avenue Hotel, Holborn, to give a demonstration every evening of the culinary possibilities of potatoes. This aroused great interest. A special leaflet, showing 20 of the more popular ways of cooking potatoes, was prepared by the Ministry for circulation at this demonstration.

In conclusion, it may be added that participation in the British Industries Fair and in the Ideal Home Exhibition was undertaken with a two-fold purpose: (1) to demonstrate by collective advertisement that home-grown produce can hold its own in point of quality with the more widely advertised imported goods, and (2) to encourage a sentiment in favour of home produce. Without exception, those who exhibited produce agree that, in both respects, the Great Britain sections have amply justified themselves. There is no doubt that the King and Queen were voicing the views of the majority of the visitors to the British Industries Fair when, after making a thorough inspection of the stands, Their Majesties expressed their gratification that British produce was so well represented.

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SUGAR BEET GROWING

FOR the first time in history, this country is now producing within its shores a substantial proportion of the enormous home consumption of sugar. The rapid increase in the area under sugar beet during the past few years—from 3,000 acres in 1920 to 125,000 acres in 1926, and probably a further increase to 200,000 acres in 1927—is due to the interest taken by successive Governments in the crop, culminating in the generous subsidy granted in 1924 for a period of ten years. This subsidy is on a sliding scale: for the first four years, *viz.*, 1924 to 1927, it is at the rate of 19s. 6d. per cwt. of sugar produced; for the next three years, at 13s. per cwt.; and for the last three years, at 6s. 6d. per cwt. In addition, a certain fiscal advantage is enjoyed as compared with sugar produced outside the Empire. With the help of these concessions, sugar-beet factories are now able to offer an attractive price to farmers, sufficient to produce a wide expansion of the area under beet. This price must inevitably fall with the subsidy, and when the latter ceases the home sugar-beet industry must stand on its own feet, enjoying only such fiscal advantage as may be granted to sugar produced within the Empire.

The advantages of the crop, both nationally and from the point of view of the farmer, are many. The sugar beet is a deep-rooting plant, requiring good cultivation and heavy manuring, which react favourably on succeeding crops. The crop provides an exceptionally large quantity of human food per acre. It is grown by the farmer under contract with the sugar factory, so that he is saved the trouble of finding a market for his produce, and it provides an excellent cleaning crop in the rotation, for which the farmer receives a cash return in place of the ordinary root crop of mangolds or turnips, which is expensive to grow and often unremunerative. It encourages good cultivation, since the price the farmer receives depends on the sugar content and yield of his crop; and the residues, in the form of tops and leaves, as well as the dried pulp obtained after the extraction of the sugar, provide useful food for stock. The manufacture of sugar in the factories has to be carried on day and night for a period of about 100 days, from October to January, and this provides work for about 500 men at each factory at a time when the labour requirements on the land are practically at their lowest.

From every standpoint, therefore, it is to be hoped that the home production of beet sugar will prove to be permanent, but if this end is to be attained the cost of production and manufacture must be reduced within the next few years, so that when the subsidy terminates the industry will still be attractive to all concerned.

There are still points connected with the growing and harvesting of the crop on which the best method of procedure is debated, and a wide series of trials is at present being laid down to investigate these questions. It may be said at once, however, that the relatively low average yield of eight tons per acre, which is at present obtained in this country, must be substantially increased if the industry is to continue as an economic proposition when the subsidy is withdrawn. Existing knowledge of cultivation methods is already adequate in most respects, and high yields are obtained by farmers who choose their land with care, make the crop a first consideration in their farming policy, and give it the attention which it needs.

The notes which follow, dealing with the growing and handling of the crop, are compiled from various sources,* and represent experience both in this country and on the Continent. Although the broader lines of good cultivation are established, however, it should be emphasized that the farmer must experiment for himself. Only by constant attention to the crop in the effort to secure the maximum yield at the minimum cost can sufficient improvement be secured to maintain the home production of sugar as a permanent industry in this country.

Climate.—The English climate is exceptionally favourable for sugar-beet growing, and the relatively mild autumn and early winter enable the farm and factory processes to be continued for a longer period than on the Continent. The crop requires a long growing period, the latter part of which must be fairly warm and not too wet. At the time of ripening the formation of sugar takes place, and this is materially expedited if a few days of frost terminate the growing period during autumn. A warm summer with sufficient rainfall at the start

* For more detailed information readers are advised to consult *Sugar Beet and Beet Sugar*, by R. N. Dowling, N.D.A. (London: Ernest Benn & Co.) Much of the information given in this article has been obtained from this source and from Mr. Dowling's earlier book, *Sugar Beet from Field to Factory*. (2s. 6d. Published in 1925 by the same publishers.)

is desirable—the amount of summer rainfall required differing, of course, with the type of soil, heavy soils needing less than light soils.

Soil.—Sugar beet is being successfully grown on the large majority of soil types in this country, with the possible exception of very heavy clays. The ideal soil is a deep, friable, and free-working loam, free from stones, with a consistency neither too light for reliable cropping in a dry season nor too heavy to cause difficulty in a wet season. Under suitable soil conditions the beet grows a long tapering root without fangs; this is easy for lifting and the most suitable form for factory purposes, inasmuch as the maximum sugar extraction is secured.

Some of the more important characteristics that sugar beet does not like in soils are (1) the presence of a "pan" or hard, impenetrable condition under the plough depth; (2) excess of water in a badly drained soil; (3) an acid or sour soil suffering from a marked shortage of lime and the presence of an excess of organic matter; (4) any condition upsetting the natural supply of water from below, *e.g.*, a gravel subsoil. In regard to the first-named objection, there is evidence that the practice of subsoiling may overcome it and make the soil satisfactory, if otherwise suitable.

Rotation.—Sugar beet may be substituted for mangolds or swedes in any of the ordinary rotations practised in this country. It does well after cereals and it makes a good preparatory crop for winter wheat if it can be lifted soon enough. It is a splendid preparation for potatoes, and, in fact, for any crop requiring a deep rich tilth. Many farmers in this country have grown oats and barley after sugar beet with marked success. Although sugar beet generally replaces part of the root crop or potatoes on suitable land, it can be grown as required in odd fields irrespective of a definite rotation. It can be successfully grown for two or three or more years in succession on the same land, although this course is open to the grave risk of encouraging insect pests.

Seed per Acre.—At least 15 lb. per acre is required to be sown under the factory contracts, and in most cases this quantity could be increased with advantage. The ideal to be aimed at is the quantity of seed which, in an ordinary season, will provide, after singling, a regular plant without gaps. As transplanting is not done with beet, any blanks due to irregular seeding become a definite factor in determining the yield per acre. The seed is supplied by the factory, and although farmers are now being given a choice of varieties, little knowledge

exists as to their relative merits in this country. This question is now being investigated, and farmers would be well advised to pay attention to the point and also to note the name of the firm from which their seed is obtained, as knowledge of the behaviour of stocks would be of great value. At present the seed is as a rule obtained from the Continent, although the possibility of producing it in this country is being explored. Sowing is usually done on the flat, although some farmers favour ridges, which reduce cultivation costs. The width apart of the drills is a debated point. Continental experience favours a width of 15 in. between the rows, and a distance of 10 in. between the beets in each row. In this country, however, there is some evidence that a wider drill width, say from 18 to 22 in. on the flat, and 24 in. on the ridge, produces an equally good crop and considerably facilitates cultivation. Singling 8 to 10 in. between the beets according to the width of row is suitable—the wider the row, the closer the singling.

The time of drilling is important. If the crop is sown too soon, the early growth, if succeeded by a spell of cold weather, induces a tendency to "bolting." Generally speaking, seeding time starts about the middle of April and goes on throughout May. The most suitable time is when the soil is in a free-working, moist condition and the temperature sufficiently high to promote quick germination and steady growth. Growers of large areas usually sow in sequence; this allows the various sowings to be singled with a smaller number of workers.

Preparation for Sowing.—The autumn cultivations are similar to those usually carried out for a mangold crop, except that, whereas the dressing of farmyard manure to the latter crop is sometimes applied in the spring, it should, in the case of sugar beet, always be applied in the autumn or winter and ploughed in. If beet is following a straw crop, it is an advantage for the cultivator to be at work on the stubbles as soon after harvest as possible, to clean the land before the dung is applied and ploughing takes place. Autumn cleaning should be followed by deep winter ploughing; where possible the depth should be 12 inches or even more. The first ploughing should not be left until the spring. In power ploughing, subsoiling tines may be used on the plough, thus moving the soil to a depth of 14 to 18 in. or more, where considered advisable.

The order and nature of the workings in preparation for a seed bed will necessarily vary under different conditions, but the object should be to obtain a fine tilth to a sufficient depth and with enough firmness to ensure close contact of the

soil with the seed. This is brought about by the judicious use of the cultivator, harrows and roller, preferably a ring roller, both before and after drilling. Too much stress cannot be laid on the importance of the roller on the lighter types of soil, not only to bring about close contact of soil and seed, but to promote the upward movement of water from the subsoil to the seed area. Skilful cultivation, accompanied by drilling the seed to a proper depth (not more than 1 in., and preferably less) in an even manner, will go a long way to ensure even and rapid germination and the establishment of a good stand of healthy young plants.

Manuring.—The dressing of farmyard manure, which should be applied in the autumn or winter, should not be more than 15 tons per acre on any soil, and if it is of good quality 12 tons should be sufficient. There is a danger of overfeeding the crop with organic matter, an excess of which tends to produce foliage at the expense of root. Although, therefore, from the point of view of the rotation and the following crop, the dung may be applied to the crop direct, this may be dispensed with in cases where a dressing of dung has been applied to the preceding crop and the soil is in good heart. In such circumstances successful crops of beet can be grown with the use of artificial manures alone.

The precise manurial treatment will vary in different localities according to the nature and condition of the land and the manuring of preceding crops. The experienced grower will manure his land according to his intimate knowledge of the farm, making comparative tests to secure the best results, and no two growers will be found to act exactly alike in this respect. The under-mentioned examples are given by Dowling as an approximate guide to the relative values of the different manures on various soils, the quantities in practice being increased or reduced according to the condition of the land and the nature of the soil. In each case it is assumed that farmyard manure (12 tons per acre) has been applied. Where no farmyard manure is used the dressings should be increased by about one-third.

Type of Soil	Super-phosphate 30 per cent. cwt.	Muriate or Sulphate of Potash cwt.	Sulphate of Ammonia cwt.
Good Sandy Loams	3	1½	1½
Poor Sands	3	2	2
Limestone Soils	3	1½	1½
Clay Loams	4	½ to 1	1 to 1½
Peaty Soils	4	1½	1
Fen Soils	6	½ to 1	1

Top Dressings.—There is evidence that a profitable increase in crop yield may be looked for by an application of one or two top dressings of a quick-acting nitrogenous manure at the rate of about 1 cwt. per acre for each dressing, due consideration being given to the natural fertility of the soil, previous or present applications of farmyard manure and the amount of nitrogen applied before drilling when deciding as to quantity and number of dressings. The dressing may take the form of any of the quick-acting fertilizers, such as nitrate of soda or nitrate of lime, the first dressing being applied at singling and the second two or three weeks later.

Experience, however, both on the Continent and in this country, is tending towards heavier applications of nitrogenous fertilizers—up to 3 cwt. per acre before drilling—followed by a top dressing of 1 cwt. nitrate of soda per acre immediately after singling.

On sandy loams the use of nitrate of soda as the only source of nitrogen applied before sowing the seed is recommended by some authorities. Calcium cyanamide can be used to replace sulphate of ammonia if desired, but it should be applied separately and some weeks in advance of the ordinary mixture. Where the soil is poor in lime, nitrate of soda, nitrate of lime or calcium cyanamide may be used as a source of nitrogen.

Potash.—On sandy and the lighter types of soils it is well to apply the potash dressings as kainit or potash salts, which should be broadcast earlier than the rest of the mixture, or it is a good plan to apply part as kainit or potash salts early and the remainder as muriate of potash with the mixture. If kainit (14 per cent.) is used nearly four times the quantities will be required as given above for muriate, which contains about 50 per cent. of potash, and if 20 per cent. or 30 per cent. potash salts are used the quantities should be increased in proportion to their decreased potash contents. The time for applying the mixture is when working the land down for drilling.

Drier for Mixtures.—The addition of steamed bone flour at the rate of 2 cwt. per ton of mixture will keep the latter in dry condition and assist the manures to run easily through the distributor.

Hoeing and Singling.—It must be emphasized that success in sugar-beet cultivation depends very largely on adequate hoeing and early thinning of the crop, the object being to cause all the efforts of growth to be concentrated upon the best plants which are being isolated to create the sugar. The horse

hoe should be at work as soon as the plants are visible in the rows. It is advisable to have them fitted with protecting discs for the first early hoeing. Several such light draught horse hoes are now on the market capable of hoeing two or four rows at a time. The ordinary corn multiple hoe can easily be converted for sugar beet by fitting wider shares and disc coulters. The corn hoe should be run on the same breadth as the drill. In hoeing care should be taken not to damage the leaves or to draw away the soil from the roots. Hoeing must be maintained not only by the horse hoe between the rows but by the hand hoe between the plants in the row. This hand hoeing should also start early, and the plants should be struck out or bunched as soon as the second pair of leaves appears and when the plants are but 1 inch high. Hoes with 5 to 6 inch blades are generally used for singling the plants to a width of from 8 to 10 inches, care being taken that there are no doubles left in the row. Singling is done by hand on the Continent, and where possible this is much the better plan. The best plant in the bunch is selected; two fingers of the left hand are used to protect it, *i.e.*, one on each side of the plant, with the back of the hand resting on the land. Then the other plants are pulled away with the right hand, and the soil pressed round the remaining plant by the two fingers of the left hand that are used to protect it.

Where the plants are first gapped, singling should follow immediately. This operation is often left too late, with consequent increase of costs and decrease of crop yield, and the importance of singling when the plants are really small cannot be too strongly emphasized. Farmers do not always realize how much damage is done by careless singling, careless hoeing, and by horses' feet during the operation of horse-hoeing; nor do they appreciate the fact that delay in thinning inevitably means reduced yield. Beet growing requires frequent cultivation of the land after singling until the leaves meet and prevent working without damage. It necessitates special attention to the loosening of the soil between the plants. This allows light and air to penetrate the soil to the benefit of the crop.

Harvesting.—Ripeness is indicated by drooping of the outer leaves and their changing to a yellowish-green colour. About three-quarters of the foliage should have wilted, but the central leaves should still be fresh and green. Unless only a small area is grown, which can be dealt with by a specially designed

spade or two-pronged fork, lifting should be carried out by a horse-drawn lifter, of which several simple and comparatively inexpensive types are on the market. This loosens the beets so that they can easily be pulled out by hand from the surrounding soil. They are then knocked together two at a time to remove as much soil as possible, and laid in rows. The roots should then be topped, which can best be done by one blow of a heavy knife as they lie in rows. Thereupon they are thrown into heaps; if not to be carted immediately, the heaps should be covered with tops.

The operation of topping requires care, inasmuch as the cut must be made at a point below the lowest leaf or bud so as to decapitate that part that was growing above the soil surface known as the crown. The crown is useless for sugar extraction and harmful to the manufacturing processes.

If the roots have to be kept for several weeks before the factory can take delivery, they should be topped and lightly covered, for example, with the tops and leaves. If a longer delay is involved, it is advisable to put the roots into clamps, which should not be too big, and should be first covered with soil, then with straw, and then with more soil, care being taken to ventilate them during the early period of clamping.

Delivery to the Factory.—The price paid by the factory is a delivered price per ton of washed and topped beets, and varies according to the sugar content of the crop as ascertained by the factory chemist. A calculation is made of the percentage of tare delivered by the grower in a fair sample, which is washed and retopped (if necessary). It is, therefore, to the grower's interest (*a*) to top correctly, and (*b*) to send the roots as free from dirt as possible, as otherwise he will be paying carriage upon weight for which he does not receive payment. The roots are washed at the factory and not by the grower. As the sugar content is ascertained from a sample of the roots in the form in which they enter the factory, and as the crown contains a relatively small amount of sugar, the grower who does not top properly will reduce the proportion which the sugar content bears to the weight of the whole root. This is important to him in its effect upon his price. If he fails to attend to the points set out above, he will reduce his profit per acre, as he is paid according to the actual net tonnage delivered. He should also fully load the railway trucks, as the carriage rate for beet is fixed upon a minimum load of six tons.

By-Products—(1) *Sugar-Beet Tops.*—It is computed that five tons or more of sugar-beet tops per acre, including about one ton of crowns, remain on the field after removal of the roots. These may be ploughed in or, as is the general practice on the Continent, used for feeding to stock. Although a watery food, containing no more than about 15 per cent. of dry matter, the latter is very rich in protein and carbohydrate, nearly one-quarter of the latter being present in the form of sugar. Broadly speaking, the chemical composition closely resembles that of other forms of succulent green forage. It is computed that the starch equivalent of the material is 54 lb. per 100 lb. of dry matter—a very satisfactory nutritive value, higher than that of the best quality meadow hay.

The tops are sometimes collected and carted for feeding to dairy cattle, but the simplest and most usual form of utilizing them consists in allowing sheep to eat them off the land. By this means the trouble and expense of carting are avoided, and the return of manurial residues to the soil is assured. In the eastern counties they have been found especially good food for the ewe flock.

An alternative method of feeding the tops is in the form of ensilage. On the Continent ensiling alternate layers of beet tops and wet pulp is a common practice ; this method has been tested at Cambridge with good results. Clamp silage, another common Continental method, has also been successfully tried in this country. The whole subject of ensilage, however, requires further investigation.

(2) *Sugar-Beet Pulp.*—The grower is allowed, under the beet contract, to purchase from the factory up to 5 per cent. of the net weight of beet delivered in dried beet pulp at the special price stated in the contract. This dried pulp can be stored over long periods, and is a popular feed on the Continent and in America. It can be satisfactorily fed dry, but where large allowances are given in the rations the pulp should be soaked before feeding, in which process it takes up more than twice its weight of water. Satisfactory results are being obtained in this country from feeding to all classes of farm stock, including dairy, and all classes of cattle, sheep, pigs and poultry. With animals receiving heavy allowances of mixed protein concentrates a little pulp may be included in the ration with advantage, since it lightens the mass of concentrate and has a laxative effect, thus preventing digestive troubles. In regard to nutritive value 1 lb. of dried

pulp may be considered equal to about 8 lb. of mangolds. From ½lb. to 1lb. may be fed to ewes with advantage when roots are not available. The use of the wet beet pulp is limited to farms in the vicinity of the factories, owing to the cost of transport. Dairy cows consume the wet pulp with relish and yield milk of good flavour provided it is fed in not too large quantities. The beet pulp should be balanced with hay and concentrates to compensate for its deficiencies in protein and mineral constituents, and, of course, roots should not be included in the ration. The wet pulp must be used with care, as it tends to spoil rapidly on exposure to air. For this reason it is frequently preserved in silos or pits with or without beet tops. On the Continent, molasses, a factory by-product, is mixed with wet or dry pulp and fed to stock.

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TRIALS OF MANGOLDS, SWEDES, AND MAIN CROP POTATOES, 1926

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THE following preliminary notes on yield and quality trials of mangolds and swedes, and yield and maturity trials of potatoes, are published as having immediate interest. In 1925 the National Institute of Agricultural Botany began three-year trials of mangolds and swedes, both at Cambridge and its sub-stations. The varying effects of seasonal factors make it necessary to defer definite recommendation until the trials are pleted ; but brief progress reports after each year's trial will no doubt be of interest to farmers. Particulars of the 1925 trial are about to be published in the Institute's *Journal*, No. 6,* and the following notes provide a summary of the 1926 results.

Mangold Trials.—In the mangold trials, carried out at six stations in 1926, the following three varieties were under test at all centres : Yellow Globe, Golden Tankard, and Red Intermediate. New Century was tested at Norwich only. The yields of roots are given in Table I. Yellow Globe was used as the common standard against which each of the other varieties was tested. To facilitate comparison of the results, they are expressed in percentages, the yield of Yellow Globe being expressed as 100 per cent., and those of the other varieties as percentages thereof. For example, at Sprowston, Red Intermediate yielded 18·8 per cent. more than Yellow

* Obtainable from the Secretary, N.I.A.B., Huntingdon Road, Cambridge, price 1s. 2d. post free.

TABLE I.—MANGOLD TRIALS, 1926: YIELD OF ROOTS PER ACRE.

	Cambridge	Sprowston, Norfolk	Long Sutton, Hampshire	Leegomery, Shropshire	Newton Abbot, Devon	Good Easter, Essex	Average
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Yellow Globe (Control) ..	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**
Red Intermediate	94·2	118·8	111·8	93·1	99·0	101·7	103·1
Golden Tankard	69·1	71·4	81·2	83·0	78·5	84·7	78·0
New Century	—	92·8	—	—	—	—	92·8
Average yield of Yellow Globe in tons per acre	Tons 27·5	Tons 26·11	Tons 26·07	Tons 23·9	Tons 12·97	Tons 29·05	Tons 24·27

TABLE II.—MANGOLD TRIALS, 1926: YIELD OF DRY MATTER PER ACRE

	Cambridge	Sprowston, Norfolk	Long Sutton, Hampshire	Leegomery, Shropshire	Newton Abbot, Devon	Good Easter, Essex	Average
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Yellow Globe (Control) ..	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**
Red Intermediate	105·4	130·0	112·8	90·5	109·2	116·0	110·7
Golden Tankard	93·5	92·8	94·5	103·6	103·7	105·8	99·0
New Century	—	96·0	—	—	—	—	96·0
Average yield of Yellow Globe in tons per acre	Tons 2·59	Tons 2·54	Tons 2·46	Tons 2·36	Tons 1·61	Tons 3·15	Tons 2·45

Globe, and Golden Tankard 28·6 per cent. less. In considering a single year's trial, little attention should be paid to differences of less than 10 per cent.

On these figures there is little to choose between Yellow Globe and Red Intermediate, except at Sprowston and Long Sutton. Golden Tankard, as was to be expected, gave a much lower yield than any of the other varieties.

Yield of roots, however, is not the only point to be considered; the farmer who grows roots for consumption on his own farm is also interested in the feeding value of the crop. It is usually held that dry matter and sugar content are the best indications of quality in this respect. These two features have been determined by laboratory analysis, and in Tables II and III are given the yields of dry matter and sugar per acre at every station, Yellow Globe again being taken as 100 per cent. in each case.

Red Intermediate proves superior in dry matter as in yield: at every station except Leegomery the dry matter per acre is greater than that of the other varieties. On this basis there is little to choose between the remainder, but it should be noted that the high quality of Golden Tankard largely compensates for its low yield of roots. As was to be expected, the quantity of sugar in the roots follows the dry matter. Red Intermediate is markedly above the remainder except at Leegomery.

It is interesting to note that at Leegomery Red Intermediate did badly both in yield and quality, and farmers in that area might be wise to await further trials before growing it. In the other districts Red Intermediate is the outstanding variety in the trial when yield and quality are considered together. For yield of roots alone Yellow Globe runs it very close, but if quality, rather than yield of roots, is the main consideration, Golden Tankard is at every station the best of these varieties to grow.

It must be pointed out that in these trials no account is taken of keeping quality, ease in lifting, or other features which, apart from yield and feeding value, must influence farmers in their decision as to what variety to grow.

Swede Trials.—The data from these trials have been dealt with in the same way as those of the mangold trials given above. Table IV gives the yields of roots per acre. The control—Round Purple Top—is represented as 100 per cent., and the other types are calculated as being so much per cent. better or worse than the control.

TABLE III.—MANGOLD TRIALS, 1926: YIELD OF SUGAR PER ACRE

	Cambridge	Sprowston, Norfolk	Long Sutton, Hampshire	Leegomery, Shropshire	Newton Abbot, Devon	Good Easter, Essex	Average
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Yellow Globe (Control) ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Red Intermediate	104·4	128·3	122·1	94·6	129·8	116·1	115·9
Golden Tankard	86·1	92·3	110·1	105·4	117·4	106·8	103·0
New Century	—	107·6	—	—	—	—	107·6
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Average yield of Yellow Globe in tons per acre	1·65	1·58	1·44	1·56	0·85	2·08	1·53

TABLE IV.—SWEDE TRIALS, 1926: YIELD OF ROOTS PER ACRE

	Cambridge	Sprowston, Norfolk	Long Sutton, Hampshire	Leegomery, Shropshire	Good Easter, Essex	Average
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Round Purple Top (Best of All) Control ..	100·0	100·0	100·0	100·0	100·0	100·0
Tankard Purple Top (Giant King)	95·4	96·0	102·0	86·8	105·5	97·1
Semi-Tankard Purple Top (Superlative) ..	119·0	109·0	103·3	106·1	108·9	109·3
Round Bronze Top (Gateacre)	111·1	107·0	107·5	107·8	113·0	109·3
Globe Green Top (Conqueror)	98·0	100·5	122·5	92·8	102·6	103·3
Smith's Green Top	84·4	94·7	120·6	94·0	90·2	96·8
Purdy's Swede	—	115·8	—	—	—	115·8
	Tons	Tons	Tons	Tons	Tons	Tons
Average yield of Round Purple Top in tons per acre	13·12	13·64	7·66	19·09	21·73	15·05

It should be noted that at Long Sutton the yields (and as a consequence the accuracy of the trial) were so low that little attention can be paid to the results. At the other centres any differences of more than 8 per cent. may be regarded as of practical importance.

Purdy's Swede is a local production of Norfolk and is not on the market. This, combined with the fact that it was only tested at one station, makes its behaviour of little more than local interest for the present. Semi-Tankard Purple Top has shown consistently high yield, as was the case in the 1925 trials. Round Bronze Top has equalled it in the present year, thus improving on its behaviour in 1925. Smith's Green Top, which is also not yet on the market, gives a low total yield as in the previous year, except at Long Sutton.

In yield of dry matter, the differences between types are very small, except in the case of Purdy's Swede and Smith's Green Top. In most cases they reverse the 1925 results. Purdy's Swede owes its position at the head of the list to its high yield of roots, but Smith's Green Top comes up from last to second on account of its high content of dry matter.

In yield of sugar per acre Purdy's Swede is again top, but this is, as said before, only as a result of a single trial. Smith's Green Top comes second, again making up by its quality for its low yield of roots. Although it holds its high average position mainly as a result of its very good showing compared with the others at Long Sutton (where all types did badly) it did quite well at the other stations, and the two years' tests suggest that it may prove a useful type where farmers wish to grow small bulks of roots of consistently high quality for home consumption. Where greater bulk is desired, probably Round Bronze Top or Semi-Tankard Purple Top would be more satisfactory. When the 1927 trials are finished it is hoped to be able to decide how far these results hold good from year to year.

Main Crop Potatoes.—Following the practice adopted above in the case of roots, the ensuing tables give the main data of the Institute's potato trials in 1926. Both in this year and in 1925, varieties normally placed in the main crop group were under test. A full report of the 1925 trials is being published at an early date in the *Journal* of the Institute, No. 6, now in the hands of the printer, and a similar detailed report on the results now under review will be given in the same publication at a later date.

TABLE V.—SWEDE TRIALS, 1926: YIELD OF DRY MATTER PER ACRE

	Cambridge	Sprowston, Norfolk	Long Sutton, Hampshire	Leegomery, Shropshire	Good Easter, Essex	Average
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Round Purple Top (Best of All) Control ..	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**
Tankard Purple Top (Giant King)	94·5	92·0	107·3	88·7	107·2	97·9
Semi-Tankard Purple Top (Superlative) ..	105·7	98·2	104·2	92·3	101·9	100·5
Round Bronze Top (Gateacre)	106·6	100·6	106·5	100·7	104·4	103·8
Globe Green Top (Conqueror)	98·5	100·7	113·8	84·3	102·8	100·0
Smith's Green Top	94·3	103·5	138·8	108·1	97·0	108·3
Purdy's Swede	—	113·8	—	—	—	113·8
Average yield of Round Purple Top in tons per acre	Tons 1·41	Tons 1·56	Tons 0·81	Tons 1·61	Tons 2·19	Tons 1·52

TABLE VI.—SWEDE TRIALS, 1926: YIELD OF SUGAR PER ACRE

	Cambridge	Sprowston, Norfolk	Long Sutton, Hampshire	Leegomery, Shropshire	Good Easter, Essex	Average
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Round Purple Top (Best of All) Control ..	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**	**100·0**
Tankard Purple Top (Giant King)	87·5	89·6	100·0	79·1	102·6	91·8
Semi-Tankard Purple Top (Superlative) ..	111·7	98·6	102·8	97·3	107·1	103·5
Round Bronze Top (Gateacre)	116·3	102·7	107·5	111·5	100·0	107·2
Globe Green Top (Conqueror)	106·2	95·6	110·5	94·0	87·3	98·7
Smith's Green Top	95·2	98·5	129·3	114·0	104·5	108·3
Purdy's Swede	—	126·5	—	—	—	126·5
Average yield of Round Purple Top in tons per acre	Tons 0·65	Tons 0·71	Tons 0·37	Tons 0·67	Tons 1·13	Tons 1·01

For the sake of clarity in the present instance, the behaviour of each variety is compared with one of the included varieties (Kerr's Pink) which was represented in the trials at all stations. The trials were conducted in a similar manner to the potato trials carried out by the Institute in previous years. It will be seen that the yield results from the several stations vary considerably, and the amount of reliance to be placed in the average must be small. The trials, however, furnish some indication which may be of use to growers, though they are not in any way conclusive.

TABLE VII.—YIELD OF TUBERS PER ACRE

	Ormskirk, Lancs	Kirton, Lincs	Truro Cornwall	Average
	Per cent.	Per cent.	Per cent.	Per cent.
(1) Kerr's Pink	**100·0**	**100·0**	**100·0**	**100·0**
(2) Up-to-Date	—	107·0	86·6	96·8
(3) Majestic	97·0	100·2	85·5	94·2
(4) McGill and Smith's 8215	72·5	102·4	97·9	90·9
(5) Rhoderic Dhu	93·8	81·5	-	87·7
(6) Tinwald Perfection ..	77·5	83·5	101·8	87·6
(7) Arran Chief	-	91·4	83·4	87·4
(8) Arran Consul	85·2	73·5	95·6	84·8
(9) King Edward	- -	75·9	91·2	83·6
(10) Ally	84·1	74·2	82·5	80·3
(11) Bishop	70·3	67·7	-	69·0
(12) Golden Wonder	51·0	-	-	51·0
(13) Field-Marshal		48·2	29·7	39·0
	Tons	Tons	Tons	Tons
Yield of Kerr's Pink in tons per acre	13·48	13·70	9·74	12·31

It can definitely be stated that Kerr's Pink is one of the heaviest croppers in cultivation. The particular stock of Up-to-Date grown in this trial has done very well, but there are many stocks in the country which have lost their vigour through virus diseases, and the result in the case of this variety in the present trials must not be taken as a general estimate of its value. Majestic has behaved much more according to expectation than in 1925, when a weak stock was undoubtedly responsible for its poor showing. The remainder need little comment except for Field-Marshal. This variety was undoubtedly represented by an inferior stock, and the 1925 result is more likely to be reliable.

Saleable produce is all that fails to pass through a $1\frac{1}{4}$ in. riddle, *i.e.*, "ware" plus "seed." Majestic (as was to be expected) and Arran Consul have done very well in this

TABLE VIII.—YIELD OF SALEABLE PRODUCE PER ACRE

	Ormskirk, Lancs	Kirton, Lincs	Truro, Cornwall	Average
	Per cent.	Per cent.	Per cent.	Per cent.
(1) Majestic	125·5	109·4	118·5	117·8
(2) Arran Consul	113·5	85·3	121·8	107·2
(3) Up-to-Date	—	110·9	90·1	100·5
(4) Kerr's Pink	100·0	100·0	100·0	100·0
(5) Tinwald Perfection ..	83·6	85·6	129·5	99·6
(6) Rhoderic Dhu	111·8	85·3	—	98·6
(7) McGill and Smith's 8215	67·2	103·1	119·0	96·4
(8) Ally	102·4	81·3	99·5	94·4
(9) King Edward	—	83·4	97·8	90·6
(10) Arran Chief	—	89·5	90·4	90·0
(11) Bishop	75·7	68·7	—	72·2
(12) Golden Wonder ..	42·1	—	—	42·1
(13) Field-Marshal	—	50·6	29·3	40·0
	Tons	Tons	Tons	Tons
Yield of Saleable produce of Kerr's Pink, per acre ..	7·86	10·58	5·73	8·06

respect, while 8215 did exceptionally badly at Ormskirk. This is not an isolated instance of the behaviour of 8215, for the same point was noticed in field crops of the variety at Cambridge, Barley (near Royston), and also in one instance in Scotland. The behaviour of the rest of the varieties needs no comment.

TABLE IX.—DAYS TO MATURE

	Ormskirk, Lancs	Kirton, Lincs	Truro, Cornwall	Average
	Per cent.	Per cent.	Per cent.	Per cent.
(1) King Edward	—	80·4	79·2	79·8
(2) Ally	80·1	79·7	84·0	81·3
(3) Bishop	83·0	82·9	—	83·0
(4) Golden Wonder ..	83·4	—	—	83·4
(5) Tinwald Perfection ..	82·7	83·1	85·4	83·7
(6) Field-Marshal	—	85·5	82·9	84·2
(7) Majestic	80·7	83·8	89·5	84·7
(8) Arran Consul	85·4	87·6	89·0	87·3
(9) McGill and Smith's 8215	83·6	88·1	91·4	87·7
(10) Up-to-Date	—	91·0	86·2	88·6
(11) Arran Chief	—	92·4	90·5	92·0
(12) Kerr's Pink	100·0	100·0	100·0	100·0
(13) Rhoderic Dhu	100·0	100·8	—	100·4
	Days	Days	Days	Days
No. of days taken by Kerr's Pink to mature	175·0	189·3	170·0	181·1

It is somewhat surprising that King Edward matured so early in these trials, which would suggest that it is earlier than Ally, which is classed by most experts as a second early. The maturity of Kerr's Pink and Rhoderic Dhu is extremely late. There is nothing notable concerning the behaviour of the remaining varieties.

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REPORT OF PROCEEDINGS UNDER THE TITHE ACTS DURING 1926

THE following Report deals with the business transacted in the Ministry under the Tithe Acts during the year 1926.

Total Amount of Tithe Rentcharge.—The total amount of tithe rentcharge charged on lands in England and Wales by the Tithe Act, 1836, and the amending Acts, was £4,054,405. It is estimated that, by the end of the year 1926, this sum had been reduced by redemption, merger and other means to about £3,249,000. There are no available statistics showing exactly what portion of this estimated sum of £3,249,000 was payable to incumbents of benefices, but the amount was probably about £1,889,000. It may further be estimated that about £273,000 was owned by the Ecclesiastical Commissioners, £96,000 belonged to ecclesiastical corporations, and £209,000 was owned by the Welsh Church Commissioners, the balance of £782,000 being held by various schools, colleges, charities and individual lay owners.

Redemption of Tithe Rentcharge.—The number of redemption cases completed in 1926 was 1,795, of which 281 were "compulsory" and 1,514 "voluntary," but in several cases rentcharges owned by two or more different titheowners were separately redeemed by these proceedings, and the total number of separate redemptions effected was 2,157.

At the end of the year 1926, the number of compulsory redemptions in progress was 674, comprising areas owned by many thousands of small property owners.

The total amount of consideration money and expenses, collected by the Ministry in connexion with compulsory redemptions in 1926, was £69,700, and the number of property owners affected by these proceedings was 27,970.

Altered Apportionment of Tithe Rentcharge.—The number of cases completed during the year was 527, of which 370 were voluntary and 157 compulsory. In the latter cases, tithe rentcharges, amounting to £6,326 and charged on 31,823 acres, were re-apportioned among 1,006 landowners. The total of the expenses assessed upon these landowners was £2,413, the average cost being 1s. 6d. per acre, £2 8s. 0d. per landowner, and £15 7s. 7d. per case.

Merger of Tithe Rentcharge.—The total number of declarations confirmed by the Minister during 1926 was 177, and the amount of tithe rentcharge thus extinguished was £3,589 12s. 1½d.

Corn Rents.—During the past year, redemptions of corn rents, rentcharges and money payments payable out of, or charged on lands in lieu of tithes, by virtue of any local Inclosure Act or other local Act of Parliament, amounting to £403 14s. 11¼d. were completed, all of which were redeemed by cash payments. The total consideration for these redemptions was £6,785 15s. 11d. Last year three altered apportionments of corn rents were completed.

Other Transactions.—Other transactions effected during the year 1926, under the Tithe Acts and other Acts affecting tithe payments, included 18 redemptions and 17 altered apportionments of extraordinary rentcharge; 8 cases of redemption under the London (City) Tithe Act, 1879, of tithe rate payable in the City of London; and 1 redemption under the Vicar's Rate in Halifax Act, 1877, affecting property in Halifax. There were also completed, two exchanges of glebe for other lands under the Tithe Acts. The number of cases of apportionment of annuities completed during the year under the Tithe Annuities Apportionment Act, 1921, was 34, and 3 cases under Section 191 of the Law of Property Act, 1925. One order was issued releasing an Order for the redemption of tithe rentcharge by annuity from the direction that a certain part of the annuity should be accumulated by investment in trust funds.

In one case a consent was issued authorizing trustees, appointed by the Ministry to receive consideration money for the redemption of tithe rentcharge, to employ the same for the acquisition of lands, etc.

APPENDIX II

SUMMARY OF TITHE RENTCHARGE REDEMPTION PROCEEDINGS COMPLETED DURING 1926

Tithe Rentcharges payable to	Number of separate redemptions completed	Amount of Tithe Rentcharge redeemed				Consideration money for redemption			Redemption Annuities imposed	
		Compulsorily by cash payment	Voluntarily by cash payment	Voluntarily by annuity	Total	Paid in cash	Being paid by Annuity	Total	Number	Total Amount
		£	£	£	£	£	£	£		£
Incumbents of Benefices	1,410	842	6,568	410	7,820	153.823	8.866	162,689	7	495
Welsh Church Commissioners	49	25	252	—	277	4,975	—	4,975	—	—
Ecclesiastical Corporations	78	47	522	-	569	10.032	-	10.032	--	—
Ecclesiastical Commissioners	177	131	694	97	922	14,065	1,691	15.756	6	95
Other owners	443	297	2,187	352	2 836	41.154	5,993	47.147	15	345
TOTAL	2,157	1,342	10,223	859	12,424	224.049	16,550	240.599	28	935

APPENDIX 1

TITHE ACTS 1836 TO 1925

TRANSACTIONS COMPLETED UNDER THE TITHE ACTS, 1836 TO 1925, AND CERTAIN OTHER ACTS

Period	Tithe Rentcharge: Redemptions: No.	Tithe Rentcharge: Redemptions: Amount of Rentcharge £ s. d.	Tithe Rentcharge: Mergers: No.	Tithe Rentcharge: Mergers: Amount of Rentcharge £ s. d.	Tithe Rentcharge: Altered Apportionments	Extraordinary Tithe Rentcharge: Redemptions: No.	Extraordinary Tithe Rentcharge: Redemptions: Amount of Rentcharge £ s. d.	Extraordinary Tithe Rentcharge: Exonerations: No.	Extraordinary Tithe Rentcharge: Exonerations: Area exonerated a. r. p.	Extraordinary Tithe Rentcharge: Altered Apportionments	Corn Rents: Redemptions: No.	Corn Rents: Redemptions: Amount of Rentcharge £ s. d.	Corn Rents: Conversions: No.	Corn Rents: Conversions: Amount of Rentcharge £ s. d.	Corn Rents: Altered Apportionments	Number of Awards of Glebe Exchange of lands, etc.	Redemptions under the Vicar's Rate in Halifax Act, 1877: No.	Redemptions under the Vicar's Rate in Halifax Act, 1877: Amount of Rate £ s. d.	Redemptions of Tithe Rate under London (City) Tithe Acts: No.	Redemptions of Tithe Rate under London (City) Tithe Acts: Amount of Tithe Rate £ s. d.	Period
1838 to 1914	19,641	69,470 6 11	17,790	151,433 5 10½	12,205	376	1,535 7 9	5	145 3 8	140	393	1,638 7 5½	24	6,921 10 5	85	1,543	289	142 3 10¼	139	1,491 1 4½	1838 to 1914
1915	255	831 18 2¼	90	3,022 15 1	282	4	4 4 10	—	—	7	7	19 16 9¾	—	—	6	5	1	0 6 1·0	3	9 7 9	1915
1916	257	1,158 7 7	62	1,271 16 9½	212	4	2 5 2	1	3 1 17	6	10	79 16 5½	—	—	2	4	3	7 14 9½	5	52 2 2	1916
1917	157	1,053 4 11¾	89	1,138 11 2¾	135	2	0 11 5	—	—	8	3	1 1 2½	—	—	—	1	3	2 3 5	7	29 13 2	1917
1918	213	1,065 16 7½	131	3,463 13 8	119	7	18 6 4	—	—	12	6	50 1 5½	—	—	1	2	—	—	1	1 19 0	1918
1919	744	8,442 4 0½	262	4,268 12 6½	208	9	40 7 3	—	—	8	13	332 18 7½	2	1,150 13 2	2	4	1	0 6 4½	—	—	1919
1920	2,213	41,344 0 4	367	4,967 7 3½	771	30	53 12 7	—	—	6	16	220 1 4	5	1,298 5 5½	3	4	—	—	12	43 15 11¼	1920
1921	4,151	96,195 2 4½	270	4,625 10 7¾	575	39	79 18 11	—	—	18	17	314 13 9	2	810 2 2	1	5	4	1 5 9	1	29 3 1½	1921
1922	4,466	125,260 1 10½	167	3,210 3 1	679	24	68 15 2	—	—	10	40	1,324 5 7½	2	373 3 8	3	3	5	2 4 3½	4	14 14 9	1922
1923	2,990	64,788 4 9	252	5,523 7 8½	746	14	24 14 9	—	—	26	18	353 19 6	—	—	11	1	2	0 10 2½	7	96 14 0	1923
1924	2,208	27,130 16 8½	156	4,851 10 8½	607	15	59 4 3	—	—	21	52	450 15 9½	—	—	3	2	3	0 15 0	7	62 2 7	1924
1925	1,854	18,007 14 2	158	4,121 10 6½	561	14	51 5 2	—	—	5	42	287 14 2	—	—	7	2	2	1 10 7½	7	108 2 4	1925
1926	1,795	12,424 0 9¾	177	3,589 12 1½	527	18	43 0 0	—	—	17	36	403 14 11½	—	—	3	2	1	0 3 3	8	104 4 2	1926
Totals	40,944	467,171 19 5*	19,971	195,487 17 2¾†	17,627	556	1,981 13 7	6	149 0 25	293	653	5,477 7 1	35	10,553 14 10½	127	1,578	314	159 4 4¾	201	2,043 0 4½	Totals

* This sum includes £667 15s. 10½d. unapportioned rentcharge and £466,504 3s. 6½d. apportioned rentcharge.

† This sum includes £46,559 0s. 4½d. unapportioned rentcharge and £148,928 16s. 10½d. apportioned rentcharge.

The fees and charges paid to the Ministry during the year ended December 31, 1926, in connexion with the work under the Tithe Acts and other incidental business were as follows :—

	£	s.	d.
Office fees	19,013	6	3
Inspection fees	403	10	0
Search charges	151	18	9
Charges for copies of, or extracts from, documents and tracings from the relative maps	1,196	9	1
	£20,765	4	1

* * * * * *

FOOT-AND-MOUTH DISEASE RESEARCH COMMITTEE: SECOND PROGRESS REPORT

THE Second Progress Report of the above committee, which has now been issued,* deals with the work carried out during the past year or so. The causal microbe, or virus, of foot-and-mouth disease cannot be seen by the most powerful microscope and it passes the finest bacterial filter. It can only be recognized by its effects upon a susceptible animal; so that, to discover its presence and activity, all experiments involve tests by inoculation. Research into the disease is, therefore, peculiarly tedious and discovery necessarily slow. Farm animals need a good deal of room, individual attention, and must be securely isolated from each other. These points present difficulties in the carrying out of experimental work. As such animals are also costly, the research worker has been compelled to use other animals for experimental purposes. Where experiments can be carried out with animals, such as guinea-pigs, it is best to utilize them.

Previous experience as to the regularity with which guinea pigs can be infected with very small doses of virus has been confirmed. Size, cheapness, and other advantageous characteristics of guinea-pigs make it possible to carry out experiments with them in sufficient numbers to draw safe conclusions. When definite indications in any direction have been obtained by working with guinea-pigs, the experiment has, whenever possible, been repeated on a smaller scale with large animals. In spite of difficulties involved in changing the habitat of the virus from one kind of animal to another,

* Published by H.M. Stationery Office. Price 3s., post free 3s. 2d.

several observations, made from work on the guinea pig, have been confirmed by subsequent experiments on cattle. The principal lines of investigation are described briefly under the nine heads below.

(1) **Further Attempts to Propagate the Virus Outside the Bodies of Animals.**—The propagation of the virus outside the bodies of animals would be of so much assistance in almost every department of investigation into foot-and-mouth disease that prolonged attempts to cultivate the virus on a number of different artificial media have been continued by the Committee's workers, but no success has been attained, although the virus was found to survive for considerable periods in media containing pieces of animal and vegetable tissue.

(2) **The Search for a Satisfactory Source from Animals of Virus of Uniform Activity, and the Best Conditions for its Maintenance with a Minimum Loss of Potency.**—Until the virus can be propagated on artificial media, recourse must be had to material derived from an infected animal, and the amount of this is limited. By successive passage through guinea-pigs, virus of very high potency can be obtained and maintained for long periods. Several samples of vesicle fluid have been infective for guinea-pigs when diluted to one in 10 million. Virus is very sensitive to either small alkalinity or acidity of the medium containing it, and kept best when the alkalinity was about the same as that of the blood and tissues of animals. Two samples of virus, suspended in appropriate mixtures of phosphates of soda and kept in a refrigerating room, have survived for 413 and 433 days respectively.

(3) **Determination of the Time the Virus Survives upon Glass, Hair, Fodder, Carcasses, etc.**—When dried rapidly on glass slides the virus does not usually survive the drying process, but if dried slowly and then kept chemically dry it has survived for six months; when kept in a moist atmosphere the virus is inactive after two days. These experiments did not suggest that under ordinary conditions of the atmosphere virus dried on inanimate objects which chanced to receive it would survive for long and serve to pass on the infection.

When dried on silk and woollen fabrics the virus survived from 7 to 14 days; on hay at least 15 weeks; on bran at least 20 weeks; on flour 7 weeks; on cow's hair 4 weeks; on sand 2 weeks; and mixed with salted butter

2 weeks. When mixed with an extract of hay and dried at ordinary temperatures, the virus was found to be active after 15 days; in a control, using distilled water instead of hay extract, the period of survival was 4 days. An experiment carried out at the Experimental Station showed that it was possible to infect farm animals by feeding with dry fodder which had been sprayed a month previously with diluted infective saliva.

It has been found that tissues from the bodies of guinea-pigs, killed when the blood was infective, remain virulent for considerable periods in cold store: the blood was virulent after 36 days and the bone marrow up to 96 days. Epithelium from the lesions was infective after 102 days. In the carcasses of cattle and pigs slaughtered in the early stages of foot-and-mouth disease and kept under ordinary cold storage conditions, virus has remained active for 40 days in the blood and 76 days in the bone marrow. After dry or wet salting, the virus was recovered from the bone marrow after 42 days. The disease was readily conveyed to pigs by feeding them upon crushed bones from frozen carcasses containing infected marrow. Imported carcasses of pigs with lesions of foot-and-mouth disease on them were proved to contain the virus by infection of cattle at the Experimental Station with material from the foot lesions.

Burial of the carcasses with lime did not shorten the period of infectivity. In some of the brine mixtures ordinarily used by the trade the virus was not recovered from the feet after five days, but in others it was present after a month.

(4) **Effect of Heat, Light, and Various Chemical Agents upon the Survival of the Virus.**—Virus kept at a favourable degree of alkalinity at a temperature of 37° C. survived for 3 to 4 days, but when kept at a temperature of 55° C. it only survived from 15 to 40 minutes. Direct sunlight in August killed the virus in an hour, and even winter sunlight passing through window glass shortens the survival of dried virus on glass slides by some days: a similar adverse effect was observed on virus dried on hay.

The action of a number of chemical substances on the virus has been tested with a view to preparing an innocuous but effective vaccine and to furnish information as to the best means of disinfection. Glycerine has little action upon the virus, and the same may be said of sodium chloride, sodium sulphate, and magnesium sulphate. The virus also

resists the action of sodium fluoride, phenol, toluol, lysol, hydrogen peroxide, chlorine, iodine, chloropicrin, and acetone in concentrations which rapidly destroy ordinary bacteria. The resistance of the virus to formalin (40 per cent. formaldehyde) has been tested with special care since this disinfectant was chosen to kill the virus in the preparation of a "dead" vaccine.

(5) **Plurality of Types of Virus.**—The observations of Vallée that there are two types of foot-and-mouth disease, called "A" and "O," which are indistinguishable clinically have been confirmed. Twenty strains have been examined, 17 of which came from outbreaks in this country. Of the latter only one was of the "A" type, all the others being "O" type. Both types of virus have been passaged through species of animals other than that from which they were originally maintained, but there was no indication that either type had undergone any modification.

(6) **Experimental Infection of Animals not Readily Susceptible to the Disease.**—Attempts have been made to infect rodents, cats, dogs, and birds, and when this has been successful the disease has been studied in them, particularly with regard to its contagiousness and the possible influence on the virus of sojourn in the bodies of animals which are not its usual habitat. The virus can be maintained in rodents, but the disease hardly ever passes from one to another by natural means. Neither dogs nor cats were readily infected, but cats appear to be more susceptible than dogs. A number of birds (including 34 fowls) were inoculated with guinea-pig virus, but no evidence of infection resulted. Attempts to infect calves with the excreta of fowls and sea gulls which were being fed on virulent material were unsuccessful, although occasionally the virus was recovered from fowls fed on massive doses of material containing virus.

(7) **Cross Infection Experiments between Cattle and Guinea-Pigs.**—Attempts were made to infect cattle experimentally by contact with guinea pigs suffering from foot-and-mouth disease at an early stage. Only once did infection of cattle result, an experiment in which the vesicles on the guinea-pigs' feet were opened and allowed to discharge. The converse experiment, in which guinea-pigs were kept in the stalls with infected cattle was also made, but the guinea-pigs did not contract the disease.

(8) **Immunity.**—The study of artificially produced immunity to foot-and-mouth disease in guinea-pigs has been undertaken with a view to finding a satisfactory way of protecting farm animals from infection. When guinea pigs have passed through an attack of the disease they remain resistant for a variable period, usually three to four months, occasionally longer. The degree of immunity in different guinea-pigs as the result of an attack is variable. Eight guinea-pigs were tested by intra-dermal inoculation at periods varying between 105 and 113 days after recovery: seven were unaffected and the other showed a small transient local vesicle.

The duration of acquired immunity in cattle is being tested at the Experimental Station. So far, resistance to an intra-muscular inoculation has been found 13½ months after an attack.

(9) **Conclusions.**—In concluding the Report, the Committee state that their workers have considerably extended the knowledge of the virus of foot-and-mouth disease in many important directions. They have explored the susceptibility of various small animals which might contribute to the spread of the disease. They have defined some of the conditions under which the virus may survive upon inanimate objects, fodder, and carcasses. The facts they have brought to light are of great epizootological importance. The susceptibility of the virus to various chemical substances has been determined, and the strength in which these may be suitably employed as disinfectants under various conditions ascertained. Lastly, their observations on natural and acquired immunity to the disease suggest possibilities for the ultimate protection of farm animals, which are at least encouraging, and which are being pursued.

The expenditure of the Committee during the financial year 1925 amounted to £9,476 and the total expenditure to the end of March, 1926, was just over £16,000.

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A PLEA FOR POULTRY COURSES ON FARMS

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TWENTY-FIVE years ago, the writer acted as assistant at the first itinerant poultry courses held in Great Britain. In the following years there were a few spasmodic repetitions of these courses; but recently this method of instruction has been revived in Yorkshire, and is now being taken up again

in other counties. It is with experience of such courses over an extended period of years, and, with a knowledge of the results obtained, that the writer would wish to make a plea for their more general adoption. They have proved an excellent means of demonstrating to the rank and file in the poultry industry the accepted methods of poultry management, methods which have been put to the test by many years of experiment and patient investigation.

Considerations of time and money make it impossible for the majority of boys and girls, who are looking after poultry on farms, to take a course of instruction in poultry management at an agricultural college or farm institute. Such persons form a numerous and distinct class, to which more attention might well be paid by those engaged in providing instruction in poultry-keeping. It is for their benefit that what may be called an organized day course in poultry-keeping has been primarily designed.

Instruction of this description as a rule extends over a period of three weeks, with six meetings each week. The course may be longer, but the three weeks' period has been found to serve best. The meeting place may be a barn or large outhouse which, along with the poultry equipment of the farm, has been placed by a sympathetic farmer at the instructor's disposal for the time being. Three hours a day are devoted to the work, the time being arranged to meet the convenience of the pupils. Each day's programme includes a lecture of one hour, whilst the remaining time is occupied in practical work.

Certain appliances should always be included in the equipment and demonstrated during the course, as, for example, incubators of two types, hot water and hot air; brooders of one or more kinds; coops; nest-boxes; models of poultry houses. Samples of different kinds and qualities of poultry food should also be shown.

The spring is the best time for an organized day course, because the important work of hatching and rearing can then be thoroughly taught. When the class is of three weeks' duration, it is a good plan to start incubating the eggs a week or more before the class commences: students are thus able to see actual hatching and can take part in the first week's rearing. If incubation is not started till the first day of the course, the eggs will not be hatched out till the last day, and those who have looked after the incubator for three weeks and have become thoroughly interested, suffer considerable disappointment in not being able to take any further part in the rearing of the chicks.

One great advantage of classes of this kind is that teaching matter of immediate local interest can be selected, and the local practices and conditions of the poultry industry explained; for example, if the district in which the course is held be high and exposed, special consideration can be given to the breeds and management suitable for such conditions. The local colour thus given to the instruction has a powerful influence in establishing confidence between teacher and student.

The following is an outline syllabus of a course on the lines indicated above, conducted in 1925, at Walkington, in the East Riding of Yorkshire, a district where poultry keepers specialize in egg production, the farm at which the course was conducted being well equipped for this purpose :—

Breeds and their characteristics; selection of laying and breeding stock; hatching and rearing—natural and artificial; foods and methods of feeding; housing; ducks—breeds and management; geese—breeds and management; turkeys—breeds and management; diseases—prevention and cure.

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APRIL ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

Seasonal Notes.—The Anglo-Saxons called this Oster-Monath, *i.e.*, Easter Month, not because of the prevalence of east winds which are characteristic of April, but in allusion to the Saxon goddess Eostre. The name April comes from the Roman calendar, and is commonly regarded as being derived from the Latin *aperire*, "to open," in allusion to the opening of buds, which is one of the natural features of this month.

The date at which trees and shrubs begin to put out their green foliage, and herbage begins to freshen, varies considerably from season to season, and, of course, some districts are earlier than others. Last year we had an early spring, apples being in full blossom by the middle of the month, where normally only plums are in bloom at that time. Grass was so forward and grazing conditions so good that some farmers had all their cattle out of doors both night and day in the middle of April, although in ordinary years the transfer is not completed until May 12.

On the average of many years, April is, taking all England and Wales, the driest month in the year. Generally it is a period when the land dries appreciably and when the pro-

verbial showers help rather than hinder tilth-forming operations. Occasionally, however, as in 1920, this may be a very wet month, and such conditions seriously delay spring cleaning and sowing operations on heavy arable land. Apart from that, a rainy April is proverbially beneficial to farmers ; even a cold, wet April is credited with filling the barn ; and a flood of the river Dove (between Derbyshire and Staffordshire) is said to be " worth a king's good."

Soil Cultivation.—Weed eradication and the relative economy of different methods of soil preparation are questions of importance to the practical farmer ; a third question of no less importance is that of the influence of tillage on productivity of the soil. The kind of information given in text-books on soils does not help us much on this point ; and it is not easy to give scientific explanations for the general superiority of the tilth obtained by means of spade and fork methods over that produced by horse-drawn field implements. The depth of working may be the same ; the field tilth may be as fine as that of the garden. Frequently, however, the gardener's tilth is superior to that of the farmer in respect of moisture content and looseness of texture. It is difficult when working by ordinary field methods to obtain a satisfactory degree of fineness and looseness on the top soil, without making the tilth too dry in the upper layers and too solid underneath. As a general rule, the best results on heavy soils are obtained when the desired degree of fineness and looseness are produced with the minimum of compression by implements and horses' feet.

For spring cultivations, the work of the rotary-tilling machine is commendable. Not only does it save labour and time—and therefore moisture—but evidence is accumulating that the tilth produced by rotary methods is more favourable to crop growth than that obtained by the plough and the tine implements. In this connexion, the results of a beet-growing trial in 1924, carried out at the Vienna Agricultural High School, are worthy of mention. A field that had grown potatoes in 1923 was autumn ploughed 6 in. deep, and in December a dressing of 8 tons of yard manure was spread on the back of the furrow. On April 19, 1924, part of the field was ploughed 8 in. deep and, near the end of the month, harrowed, spike-rolled and again harrowed ; it was flat-rolled on May 2 and the next day drilled with sugar beet in rows 17 in. apart. The remainder of the field was not ploughed but rotary-tilled

to a depth of 6 in. on April 26, then harrowed; on May 2, it was flat-rolled and drilled next day with the first part of the field. The yields obtained from the two methods of seed-bed preparation were as follows:—

	Yields per acre	
	Ploughed part. Tons	Rotary-tilled. Tons
Roots	9·9	12·0
Leaves and tops	8·7	7·2
Dry substances in roots	1·7	2·1
Dry substances in leaves and tops	1·3	1·1

The remarkable feature of the results of the above trial is the difference in the ratio of root to leaf in the two sets of plots. The experimenter suggests that the more intensive loosening of the soil by the rotary machine brings about a more rapid decay of the organic matter in the soil than does ploughing. This would provide a stronger stream of carbon dioxide and enable the plant to satisfy its needs for carbonic acid by means of a smaller leaf surface. This theory—the influence of the supply of carbon dioxide—has not yet been generally accepted, however.

Finger-and-Toe.—The disease known as *finger-and-toe* in turnips, and as *club root* in cabbages, is caused by a microscopic parasite, classified as a fungus, which lies dormant in the soil when there is no cruciferous crop plant or weed—such as charlock—within its reach. Soils that are deficient in lime are well known to be more commonly infected than those which are not sour; and there is ample experimental evidence that the timely application of lime to infected soils considerably reduces the proportion of diseased roots. Frequently, however, cruciferous crops have to be grown on infected land that has not received a timely and adequate application of lime. In these circumstances, advantage should be taken of additional precautionary measures against severe attack.

Fertilizers which tend to aggravate soil sourness—such as sulphate of ammonia, and compound manures containing acid ingredients, should be replaced by fertilizers that are functionally basic, such as nitrate of lime, nitrate of soda, and basic slag. Excess of potash manures should not be used. Calcium cyanamide is reported to have given excellent results in Danish experiments on this disease, but, as explained by Mr. Garner,* this fertilizer should be applied some time before the crop is drilled or planted.

* This JOURNAL, October, 1926, p. 663.

A number of official trials have demonstrated that varieties of swede differ considerably in their susceptibility to attack. In an experiment, recently carried out in East Devon, the proportion of diseased roots varied from more than 85 per cent. in the case of four varieties to 15, 25, 34, and 40 per cent. in the varieties Incomparable, Eclipse, Defiance, and Tipperary respectively. Among common turnips, green globe varieties, and a special disease-resisting purple top, showed least susceptibility to finger-and-toe. Marrow-stem kale and kohl-rabi are not immune from the disease but they are not very susceptible, and the injury caused by the attack does not, as in the case of turnips, extend to the edible parts of the plant.

The Dairy Herd.—Milk producers who farm in the Midlands and the Northern counties often criticize milk contracts in which April is grouped with the summer months. In this season's London agreement, the price falls from 16½d. per gallon in March to 12d. per gallon in April, although, in the counties indicated, costs of production remain the same, or, according to local belief, increase in April. There can be little profit on April milk at these prices, not to mention the possibility of profit where the actual net price received by the producer is only 8½d. The price of milk, however, is ruled by the law of supply and demand, and the supply is increased by the growth of the grass in the earlier districts and by the number of cows that calve about this time of the year.

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NOTES ON MANURES FOR APRIL

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Manures for Roots.—April is a period of great activity in the application of manures. Quite apart from spring corn, three exhaustive crops are sown during the month, each receiving farmyard manure and a good dressing of artificials in addition. In 1926, potatoes occupied 500,000 acres, mangolds 338,000 acres, and sugar beet 126,000 acres; and if we assume that the very moderate dressing of 4 cwt. of fertilizers per acre was, on the average, given to these crops, the total of 964,000 acres would account for nearly 200,000 tons of artificials, or about one-sixth of the quantity used for all purposes during the year.

Requirements from the Soil.—The above three crops have several points of similarity. In the first place, each makes considerable claim on the stores of plant food in the soil, and potash, in particular, is required in large amounts. Moreover, only part of the crop is removed from the field on which it grows, and the quantities of plant food restored to the soil through the leaves, in the case of mangolds and beets, is considerable. The nutrient content of the dead potato haulm is probably not large, for, in the process of dying down and decay, much of the mineral and nitrogenous matter originally contained will find its way back to the soil. Since the actual quantity of haulm and its condition at harvest time are so variable, average estimates of the nutrient content could have little value. The following figures enable the root crops to be compared with a typical grain crop in respect of the nutrients per acre required from the soil to grow the crop, the amounts which are returned to the soil direct or by way of the manure heap, and the quantity of nutrients which leave the farm as potatoes or washed beet.

Crop per acre	Nutrients, lb. per acre			Remarks
	Nitrogen	Phosphoric Acid	Potash	
19 tons Mangolds (roots & leaves)	119	46	260	Nutrients required from the soil. No data for potato haulm.
8 tons Beet (roots & leaves)	71	34	128	
6 tons Potatoes	47	22	77	
30 Bu. Wheat (grain & straw)	48	21	29	
Mangold Leaves	44	14	67	Ploughed in.
Beet Leaves	44	16	65	
Mangold Roots	75	32	193	To the dung heap, where about ½ N ¼ P_2O_5 and ¼ K_2O are lost.
Wheat Straw	15	7	20	
Washed Beet	27	18	63	Sold off
Potatoes	47	22	77	
Wheat Grain	33	14	9	

The figures show that an average root crop requires considerably more from the soil than an average crop of wheat, and, in the case of mangolds, the potash removed is nine times as great. The residues, left as leaves, contain nearly as much plant food as a full crop of wheat. The addition to the dung heap by feeding roots is considerable, and is specially valuable from the point of view of the potash supply. On the other hand, the sale of beet or potatoes is a greater drain on the farm supplies of potash than the sale of grain.

Farmyard Manure.—The next outstanding point is the value of farmyard manure. Dung has many useful physical effects, but, in addition, the nutritive effect goes a long way towards explaining the good results of farmyard manure for these crops. An ordinary dressing of 10 tons of dung not only gives a complete and considerable supply of plant food, but also provides the rich source of potash (about 150 lb. in 10 tons) which is highly desirable for roots. There is a great body of experimental evidence to show that a heavy dressing of dung is not necessary, but that a lighter dressing, helped out by a complete mixture of artificials, is equally satisfactory. The extensive experiments, conducted in Ireland, on potatoes, at 353 centres in 11 seasons (1901-11), may be mentioned in this connexion.

AVERAGE YIELDS OF POTATOES. ALL SOILS AND SEASONS.

Treatment	Tons per acre
No Manure	4·0
15 tons dung alone	8·2
20 ,, ,, ,,	9·1
15 ,, ,, + 1 cwt. Sulphate Ammonia	9·1
15 ,, ,, + 1 cwt. Sulphate Ammonia, + 4 cwt. Super.	9·95
15 ,, ,, + 1 cwt. Sulphate Ammonia, + 4 cwt. Super. + 1 cwt. Mur. Potash	10·85

Similar experience has been recorded for mangolds and sugar beet, and, provided that they are grown on light to medium soils, they, like potatoes, usually do best with a complete artificial mixture in addition to the dung. There is some evidence that on rich clay soils the potash may be reduced.

The Nitrogen Supply.—Only on rich fen soils will roots be commonly grown without any nitrogen beyond that provided in the farmyard manure. In other cases, sulphate of ammonia up to 2 cwt. per acre may be used in the drills for the potatoes; and for mangolds and beet, 1 cwt. of sulphate of ammonia in the seed bed and up to 2 cwt. of nitrate of soda in two top dressings. Since beet is at present worth more per acre than

mangolds, the higher rate of manuring might be reserved for this crop. With regard to the effects of nitrogenous top dressings on the sugar content of the beets, continental experience seems to show that, if the dressings are kept within some such limits as have been mentioned above, the depression in sugar content is trifling, and is more than outbalanced by the increased yield. Late top dressings, *i.e.*, after the end of June, are not recommended, as they prolong the growing period and thus lead to the harvesting of unripe beets.

The Phosphate Supply.—The need of phosphate varies considerably with the nature of the soil, but there will be few circumstances in which no phosphate will be needed for the root crops. The chief function of phosphatic fertilizers is to give the young plants an early start, and for this reason a supply of readily available phosphate in the neighbourhood of the young seeds is desirable. Where soil conditions allow, superphosphate should have the preference for spring sowing, but good grade basic slag is frequently used with success. Recent work at Kirton, Lincs, has shown that, under the conditions there prevailing, the customary heavy dressings of superphosphate used on potatoes could be reduced without detriment to the crop. This result is significant, and it remains to be seen how far these conclusions will be confirmed under other conditions. On ordinary soils, 3-4 cwt. of superphosphate, in addition to dung, would be a normal dressing for potatoes, mangolds or sugar beet; but under special conditions, such as in the fen district or on poor clays, these amounts are considerably exceeded. With the possible exception that, on light soils in an early ripening season, the crop may mature so quickly that the yield suffers, no harm is to be feared by using more phosphate than the plant requires. The excess of phosphate may be recovered in part in subsequent crops. On the other hand, in late districts, a good dressing of phosphate is of value in hastening the maturity of beet and potatoes.

The Potash Supply.—As already pointed out, the crops under consideration require considerable amounts of potash, of which the farmyard manure provides a large part. We must also bear in mind that heavy soils are usually able to meet some of the needs of the crop in this respect. Cereals, for example, rarely require additional potash on clay soils, and root crops show less need of outside supplies. Taking all this into account we can reckon that, where farmyard manure is used, about 1 cwt. of muriate of potash, or its equivalent, should be

allowed per acre of the above crops, the quantity being somewhat increased on the light soils and reduced on rich clays. The form of potash used is worthy of attention. Potatoes do best with high grade salts, such as the sulphate or muriate of potash, while beet and mangolds sometimes benefit from the salt which is contained in the lower grade manures, such as kainit of 20 per cent. or 30 per cent. potash salts. On soils which tend to run together with agricultural salt, the high grade muriate of potash is to be preferred. Like other fertilizers, potash is more effective in some seasons than others, as shown by the following results on potatoes at Rothamsted, obtained on different fields of the farm each year, but on soil of essentially the same type :—

INCREASE DUE TO SULPHATE OF POTASH* IN PRESENCE OF NITROGEN AND PHOSPHATE

Tons per acre

	1921		1922		1923		1924		Average
	Actual	Per cent.	Actual	Per cent.	Actual	Per cent.	Actual	Per cent.	Actual
With dung	·46	13	1·52	19	·79	7	−·36	−4	·6
No Dung	2·41	179	5·83	236	2·53	26	1·08	17	2·96

* 1½ cwt. per acre in presence of dung ; 2 cwt. without dung.

Taking the results over a series of years, the addition of potash to farmyard manure produces a slight advantage even on the heavy soil at Rothamsted. In the absence of dung, the effect of the potash is much more marked. The year 1922 showed great responses to potash at this centre, while in 1924 potash fertilizers produced no effect where dung was used.

Lime.—In their sensitiveness to lime deficiency, the three root crops show decided differences. Sugar beet and mangolds are distinctly damaged by soil acidity, and failures from this cause are quite common. The remedy is a suitable dressing of lime, chalk, or ground limestone ; but, before any action is taken, the need should be definitely proved by analysis, and the approximate lime requirement ascertained by consulting the local advisory service. Potatoes are less sensitive to soil acidity, and can be grown quite well on land where the other crops would suffer. If lime is required for the rest of the rotation it may be applied after the potatoes have been removed.

No Dung.—If no dung is available, all the above crops may be grown fairly successfully if the dressing of artificials is increased all round by about 50 per cent. On light soils, however, crops thus grown may receive a heavy check in a droughty period. On heavy land, worked with skill to obtain the necessary tilth, this risk is considerably diminished. Nevertheless, except on a few soil-types of excellent physical

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending March 9				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½%) ..	13 15	13 15	13 10	13 12	17 7
„ „ Lime (N. 13%) ..	..	..	..	11 12	17 10
Sulphate of ammonia :—					
Neutral (N. 20·6%)	12 6*	12 6*	12 6*	12 6*	11 11
Calcium cyanamide (N. 19%) ..	9 16*	9 16*	9 16*	9 16*	10 4
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 15	3 11
Potash salts (Pot. 30%)	4 17	..	..	4 10	3 0
„ (Pot. 20%)	3 12	3 2	3 9	3 2	3 1
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 7	3 6
Sulphate „ (Pot. 48-51½%)	11 10	10 5	10 16	11 5	4 5
Basic slag (T.P. 30%)	..	3 2§	3 1§	..	..
„ (T.P. 28%)	..	2 11§	2 10§	..	..
„ (T.P. 26%)	..	2 7§	2 6§	..	..
„ (T.P. 24%)	..	2 2§	..	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade ¶	2 15	..	..	2 15*d*	0 11
Fine grade ‖	2 10	..	..	2 12*d*.	0 11
Superphosphate (S.P. 35%) ..	3 9	..	3 12	3 10	2 0
„ (S.P. 33%) ..	..	..	3 9	..	..
„ (S.P. 30%) ..	3 2	2 15	3 5	3 3	2 1
Bone meal (N. 3¼%, T.P. 45%) ..	8 15	8 5	8 10	8 0	..
Steamed bone flour (N. ¼%, T.P. 60-65%)	6 0†	6 10†	6 5	5 15	..
Burnt lump lime	2 0	1 12*a*	2 0*b*	2 1*c*	..
Ground lime	2 7	2 1*a*	2 9*b*	1 15*c*	..
„ limestone	..	..	1 10*b*	..	..
„ chalk	..	1 9	..	1 5*c*	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Hull prices include delivery to any station in Yorkshire, Liverpool to any station in Lancashire. London prices are for 4-ton lots delivered in the home counties.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull.

b Delivered to Liverpool area.

c Delivered in 4-ton lots to London.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

condition, the growing of roots without organic manure is regarded as a makeshift. If, for some reason, two root crops are taken in succession, as, for example, beet following potatoes which have been well dunged, the second crop of roots may well be grown on artificials only.

Further Work.—Of the three crops dealt with, the treatment of mangolds has probably been worked out most completely, for here the question of quality, though undoubtedly worthy of attention, does not react on the returns as much in the case of potatoes or beet. Most of our information with regard to the manuring of beet comes from continental countries, and, until English experiments have progressed further, nothing better can be done than to accept the main findings of this work. Since our farmers enjoy a much bigger price margin for their product than the continental growers, this serves to mitigate the effects of any lack of precision in manurial treatment. At present manurial experiments centre round two problems :—

(1) The effect of nitrogenous top dressings in their relation to yield and quality.
(2) The extent of the need for potash and the relative effectiveness of low grade and high grade potash manures.

It is realized, however, that the working out of cultivation methods most suited to English conditions will be the main factor in improving the sugar beet crop ; experiments directed to this end are in hand at many centres and their results are awaited with interest.

Potatoes have had their requirements worked out on broad lines, and also the general effect in quality of some of the various grades of potash fertilizers. Interest is now shifting to the question of the " balance " or relative proportion of the ingredients in mixtures for potatoes. The interesting work of J. C. Wallace at Kirton has been mentioned ; and a start has been made at Rothamsted on the balance of nitrogen and potash in presence of constant amounts of phosphate.

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NOTES ON FEEDING STUFFS

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The Principles of Meat Production.—In the production of meat for human consumption, the farmer's skill is chiefly directed towards feeding his animals in such a way that they appeal to the butcher. His interest in this direction is to a

certain extent a commercial one, since an animal finished so that it "is ripe for the butcher" will command a better price than a half-finished animal. Many factors are involved in the commercial process of meat production, some of which are under the control of the feeder, and some outside his influence. The two main physiological processes governing meat production are growth and fattening. The growth processes are inherent to the individual and cannot be influenced, except in a detrimental sense, by feeding; the fattening processes, on the other hand, can be directly controlled by the feeder. In the fattening of the young animal, both growth and fattening are involved, whereas, in the adult, the growth processes have ceased. The fattening of calves, lambs, and pigs is therefore a different problem to fattening adult sheep and bullocks, and is generally recognized as such by all stockfeeders. Similarly, it must be recognized that the methods required to produce baby beef at 21 months are far different to those which suffice for fattening 2½-year old steers. It has already been mentioned that the growth processes are inherent to the individual. During growth active bone formation, and protein storage, in the shape of muscle, occurs, and the feeder is chiefly concerned in purchasing animals in which these processes are most rapid, *i.e.*, he requires animals which show early maturity. Similarly, he requires an animal which, when killed, yields a carcass which conforms to a particular type, especially so in the case of, say, the bacon pig; length of back, size of ham, width of shoulder, and fineness of bone are all characteristics of growth that are outside the control of the feeder, but fortunately they are the points to which the breeder has given attention.

One has only to compare the modern breeds with their ancestral types to realize the extent to which the breeders have improved their meat-yielding capacity, and the breed societies' standards are so formed as to encourage not only a better type of carcass, but also to increase the proportion of the better quality joints. With regard to early maturity, however, apart from the pig, little exact work has been carried out, since it is only in recent years that much attention has been paid to the early production of beef. The existence of "good" and "bad doers" in animals has led to much speculation among feeders as to the reason for such variation in the growth response of animals to similar diets. Among the varying causes assigned as responsible for such differences are variation in digestive powers of individuals and varying capacity in conversion of digested food to fat and meat. With regard to "digestive power," tests on

"good" and "bad doers" have shown that "bad doers" are equally efficient as "good doers" in the capacity to digest food; so variation in digestive power may be ruled out as a possible cause of such variation in growth response. Similarly, such experiments as have been conducted on the "assimilative power" of animals in the conversion of food to milk, fat and work have shown little variation among individuals. The explanation of such differences in growth response as undoubtedly do exist must, then, be sought for in other direc-

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Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)..	71	6·2	9 15
Maize	81	6·8	7 12
Decorticated ground nut cake	73	41·0	11 15
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·27 shillings, and per unit protein equivalent, 1·71 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 0
Oats	60	7·6	7 9
Barley	71	6·2	8 12
Potatoes	18	0·6	2 2
Swedes	7	0·7	0 17
Mangolds	7	0·4	0 17
Beans	66	20·0	9 4
Good meadow hay	31	4·6	3 18
Good oat straw	17	0·9	2 0
Good clover hay	32	7·0	4 5
Vetch and oat silage	13	1·6	1 12
Barley straw	19	0·7	2 4
Wheat straw	11	0·1	1 5
Bean straw	19	1·7	2 6

Description	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	12 2	0 14	11 8	72	3 2	1·70	9·6
Barley, British feeding	—	—	9 15	0 11	9 4	71	2 7	1·38	6·2
„ Canadian No. 3 Western	35 9	400	10 0†	0 11	9 9	71	2 8	1·43	6·2
„ Argentine	35 0	„	9 17	0 11	9 6	71	2 7	1·38	6·2
„ Danubian	34 3	„	9 12*	0 11	9 1	71	2 7	1·38	6·2
„ Persian	33 0	„	9 5	0 11	8 14	71	2 5	1·29	6·2
„ Russian	36 6	„	10 5	0 11	9 14	71	2 9	1·47	6·2
Oats, English, white	—	—	9 7	0 12	8 15	60	2 11	1·56	7·6
„ „ black and grey	—	—	9 0	0 12	8 8	60	2 10	1·52	7·6
„ Scotch white	—	—	10 0	0 12	9 8	60	3 2	1·70	7·6
„ Irish black	—	—	8 15	0 12	8 3	60	2 9	1·47	7·6
„ „ white	—	—	9 7	0 12	8 15	60	2 11	1·56	7·6
„ Canadian feed	24 0	320	8 9*	0 12	7 17	60	2 7	1·38	7·6
„ American	21 9	„	7 12†	0 12	7 0	60	2 4	1·25	7·6
„ Argentine	24 0	„	8 9	0 12	7 17	60	2 7	1·38	7·6
„ Chilian	23 0	„	8 2‖	0 12	7 10	60	2 6	1·34	7·6
Maize, Argentine	32 6	480	7 12	0 11	7 1	81	1 9	0·94	6·8
Beans, English winter	—	—	10 13	1 10	9 3	66	2 9	1·47	20
Peas, English blue	—	—	17 0*	1 6	15 14	69	4 7	2·45	18
„ Japanese	—	—	28 10‖	1 6	27 4	69	7 11	4·24	18
Dari, Bombay	—	—	12 5	0 14	11 11	74	3 1	1·65	7·2
Millers' offals—									
Bran, British	—	—	7 17	1 5	6 12	42	3 2	1·70	10
„ broad	—	—	8 17	1 5	7 12	42	3 7	1·92	10
Middlings, fine, imported	—	—	10 0	1 0	9 0	69	2 7	1·38	12
„ coarse, British	—	—	8 0	1 0	7 0	58	2 5	1·29	11
Pollards, imported	—	—	7 6	1 5	6 1	60	2 0	1·07	11
Meal, barley	—	—	11 0	0 11	10 9	71	2 11	1·56	6·2
„ maize	—	—	9 5	0 11	8 14	81	2 2	1·16	6·8
„ „ germ	—	—	8 15	0 18	7 17	85	1 10	0·98	10
„ „ gluten feed	—	—	8 15	1 5	7 10	76	2 0	1·07	19
„ locust bean	—	—	8 10	0 9	8 1	71	2 3	1·20	3·6
„ bean	—	—	12 10	1 10	11 0	66	3 4	1·78	20
„ fish	—	—	22 0	3 18	18 2	53	6 10	3·66	48
Maize, cooked flaked	—	—	10 10	0 11	9 19	85	2 4	1·25	8·6
Oilcakes—									
Linseed cake, English 12% oil	—	—	13 0	1 15	11 5	74	3 0	1·61	25
„ „ „ 10% „	—	—	12 12	1 15	10 17	74	2 11	1·56	25
„ „ „ 9% „	—	—	12 7	1 15	10 12	74	2 10	1·52	25
Soya bean, „ 6% „	—	—	11 10*	2 9	9 1	69	2 7	1·38	36
Cottonseedcake, English, 5½%, „	—	—	7 0	1 12	5 8	42	2 7	1·38	17
„ „ Egyptian, 5½% „	—	—	6 15	1 12	5 3	42	2 5	1·29	17
Decorticated cottonseed meal, 7% oil	—	—	10 0	2 9	7 11	74	2 0	1·07	35
Coconut cake, 6% oil	—	—	9 0	1 9	7 11	79	1 11	1·03	16
Ground-nut cake, 6% oil	—	—	8 2	1 13	6 9	57	2 3	1·20	27
Decorticated ground-nut cake, 7% oil	—	—	11 15*	2 11	9 4	73	2 6	1·34	41
Palm kernel cake, 6% oil	—	—	7 17‖	1 1	6 16	75	1 10	0·98	17
„ „ „ meal, 6% oil	—	—	10 0†	1 1	8 19	75	2 5	1·29	17
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1·20	2·7
Brewers' grains, Dried ale	—	—	7 10	1 2	6 8	49	2 7	1·38	13
„ „ „ porter	—	—	7 0	1 2	5 18	49	2 5	1·29	13
„ „ Wet ale	—	—	1 7	0 8	0 19	15	1 3	0·67	4·8
„ „ „ porter	—	—	1 2	0 8	0 14	15	0 11	0·49	4·8
Malt culms	—	—	7 0‖	1 12	5 8	43	2 6	1·34	16

Prices at London except where otherwise stated.

† At Bristol. * At Hull. ‖ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of February and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is £1 1s. per ton. The food value per ton is therefore £8 19s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 11s. 8d. P_2O_5, 3s. 8d.; K_2O, 3s. 0d.

tions. Such possible factors are variation in maintenance requirement, variation in feed consumption and variation in muscular movement. With regard to variation in maintenance requirement, the skin temperature experiments of Wood and Hill are significant. These workers obtained evidence that the skin temperatures of bullocks varied, the "good doers" showing a lower skin temperature than the "bad doers," indicating that the feed requirement of the "bad doers" for maintenance was distinctly higher than the "good doers." Thus on equal feed consumption, the "good doers" would store a relatively greater amount of food as fat or meat than the "bad doers." Similarly, excessive muscular exercise would constitute a drain on the available food supply, the very active animal tending to fatten less rapidly in consequence than the animal of lethargic temperament. Another factor that cannot be ignored as a possible cause of variation in rapidity of fattening, is the variable capacity of individuals to consume food. It is obvious that, of two individuals, the individual which can consume the greater amount of food per diem will have a greater margin of food available for carcass formation, and such an individual will produce more meat than his less fortunate brethren in the same interval of time; not because he makes more efficient use of the productive portion of his ration, but simply because he actually consumes more in the same interval of time.

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MISCELLANEOUS NOTES

Fowls for Meat Production

THE following note has been communicated to the Ministry by Mr. John Watson, of Kendal: The Ministry is drawing attention to experiments directed to finding out which are the best meat-producing fowls and their general table qualities. This side of the poultry industry has in recent years somehow fallen behind owing to the attention paid to that of egg production. After experimenting over a series of years, I have come to the conclusion that there is no *best breed* for producing meat. The ideal fowl should carry the maximum of meat and the minimum of offal. The meat should be carried on a full, square breast to such an extent as almost to conceal the breast-bone. The flesh should be white (not yellow) and the bone fine. It must, in addition, have a gamey flavour and be fine in texture.

The production of this type of fowl was the aim of these experiments. I have kept most of the heavy breeds, including White Wyandottes, White Orpingtons, White and Salmon Faverolles, Houdans and all the varieties of Sussex, but none of these has been satisfactory. Hens of the above breeds were next crossed with Old English Game cocks, and it was only then, in my opinion, that the perfect meat fowl was obtained. The increase in weight, more especially in the cockerels, averaged from 50 to 100 per cent.

The difficulty experienced by breeders of White Leghorns, and the lighter breeds generally, in disposing of their surplus cockerels, on account of the small amount of meat they carry, suggested the trial of the Old English Game cross in this direction, and an Old English stag was put with half a dozen Leghorn hens. At three months old the cross-bred chickens were double the weight of pure-bred ones, carried 50 per cent. more flesh, were hardier, and the pullets subsequently laid more eggs than either of the parent breeds. This cross should enable breeders in many cases to avoid rearing light-breed cockerels at a loss.

My people and I have bred Old English Game fowls for several generations, and this breed, crossed with practically any other, especially with Sussex, produces an amount of meat of beautiful texture that will prove a revelation to those who have not previously tried it.

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Special Course for Milk Recorders

A SPECIAL course on Milk Recording will be held at the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, from Monday, April 25, to Saturday, May 14, 1927. Applications for admission to the course should be addressed to the Principal. The course is being held for Milk Recorders and others who intend to take up the work of recording. Students will travel to Sutton Bonington on Monday, April 25, and tuition will begin on the following day. Each day's instruction will embrace :—

(*a*) At least two hours' theoretical teaching.
(*b*) Practical work in weighing, sampling, testing and keeping of records.

At the conclusion of the course the College will notify, in writing, those students who have satisfied their instructors as to their industry and general ability, and have passed the theoretical and practical examination held during the closing days.

Scholarships for Agricultural Workers

THE experimental scheme of scholarships for the sons and daughters of agricultural workmen and others, which was approved in 1922 for a period of five years, was concluded last year, and a record of the working of this experiment will shortly be published by H.M. Stationery Office (*Report of the Central Scholarships Committee of the Ministry of Agriculture and Fisheries*).

The Government have decided to continue the scheme in a slightly modified form as recommended by the Central Committee, and the first awards under the revised scheme will be made this year. There are two main grades of scholarship: namely, junior scholarships for short courses in agriculture, horticulture, dairying, or poultry-keeping, at farm institutes; and senior scholarships for diploma or degree courses in an agricultural or allied subject at agricultural colleges or universities, or for courses in veterinary science at veterinary colleges. The normal avenue to the senior grade is through the junior grade, but an exception is made in the case of candidates who have passed a higher school certificate examination before the age of 17 or a higher school certificate examination with distinction in at least one subject before the age of 18. Such candidates may apply for senior scholarships (honours degree courses) without passing through the junior grade.

Candidates must be (*a*) sons or daughters of agricultural workmen, or of working bailiffs and small-holders whose means are comparable with those of agricultural workmen; (*b*) bona-fide workers in agriculture; (*c*) sons or daughters of rural workers whose means and method of livelihood are comparable with those of agricultural workmen. The value of the scholarship is such as will enable students to attend the courses without cost to their parents. Provided a sufficient number of suitable applicants is forthcoming, there will be awarded this year about 120 junior scholarships, 10 extended junior scholarships (for well-qualified candidates who have held Class III scholarships under the experimental scheme), and 10 senior scholarships. The closing date for the receipt of applications is April 30, 1927.

Forms of application and full particulars may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1, or locally from the offices of county councils.

Exchange of British and Danish Agriculturists

SINCE 1924, a scheme has been in operation under which a limited number of young agriculturists from Denmark are afforded facilities to live and work on farms in this country in order to study, at first hand, the methods and practice of British agriculture; while an equal number of British agricultural students have opportunities of working for a few months on selected Danish farms. The students are required to pay all their own travelling expenses and to undertake regular work on a farm, for a period of from three to twelve months, in return for free board and lodging, no money being paid to them for their services. The National Farmers' Union assists in the selection of farms on which the Danish students can be placed, and also helps to obtain suitable British applicants for work and study on Danish farms.

In Denmark, the scheme is worked by a Bureau of Agricultural Travels under the Royal Agricultural Society of Denmark. This Bureau has organized, with the assistance of the Danish Foreign Office and the Legations in Copenhagen of the various countries concerned, a series of similar exchanges with other countries; and the Bureau each year places a number of agricultural students of different nationalities with Danish farmers of high standing, on whose farms dairy farming in general; scientific economic feeding of dairy cattle; rational breeding of dairy cattle (with particular reference to the influence of the bull in the yield of the offspring); general co-operation in production, buying, and selling; and so forth, may be studied. In England those who wish to take advantage of the scheme should make application through the Principal of a college or farm institute (if they have attended either of such institutions) or through the agricultural organizer of the county in which they are resident. It is hoped that during the present year British students will take fuller advantage of the scheme.

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Egg Marketing Poster

THE reproduction on the opposite page is of a poster, recently prepared by the Ministry, setting out points that should be observed in the marketing of eggs. With the suggestion that it might be displayed in a prominent place in the market, copies of this poster have been sent to every auctioneer who is known to handle eggs and to the Market Authority of every country market in England and Wales at which eggs are known to be sold.

EGGS

MARKET REQUIREMENTS

EGGS MUST BE NEW-LAID

Collect eggs once a day.
Keep them in a clean, cool and dry place.
Market weekly; more frequently if possible.

NEVER HOLD EGGS

Treat your market fairly.
Always candle eggs from "stolen nests."
Infertile eggs from incubators are not New-Laid.

EGGS MUST BE CLEAN

Don't wash hen eggs; use a damp cloth if necessary.

DIRT IS A POOR TRADE MARK

Keep stained eggs at home.

EGGS MUST BE UNIFORM

Don't mix hen and duck eggs.
Don't mix large and small.

GOOD APPEARANCE ATTRACTS BUYERS

You are better placed for supplying new laid eggs than the foreigner; don't fritter this advantage away.

Ministry of Agriculture and Fisheries,
10 Whitehall Place,
London, S.W. 1.

Ask your Newsagent for the following :—
Economic Series, No. 10, "Marketing of Eggs." } Published by H.M.S.O.
Economic Series, No. 11, "Poultry Marketing." } Price 6d. each.

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The response has been remarkable. The poster has been welcomed as filling a long-felt need ; applications for additional copies are numerous. One prominent auctioneer says, " I am glad to have the opportunity of displaying this poster, as it is just the type of plain speech and clear instruction that the country people round here understand and pay heed to." Another auctioneer says that where producers have followed similar advice which he, himself, has tendered, improved prices have been obtained for their eggs.

It is hoped that the few simple points noted on the poster will receive attention and so help to place English eggs on our markets in a condition and manner worthy of their quality and of the home country.

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The Agricultural Index Number

THE general index number of the prices of agricultural produce fell four points in February and at 45 per cent. above pre-war was one point lower than in December last and at the lowest level of recent years. A similar sharp decline in the index number occurred in February, 1926. Price changes in the case of most commodities were very small on the month and the fall in the general index number is due principally to lower index numbers for fat stock.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	—
April	66	54	53	59	52	—
May	69	54	57	57	50	—
June	64	49	56	53	48	—
July	67	50	53	49	48	—
August..	68	52	57	54	49	—
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain

Wheat was unaltered on the month at an average of 11s. 10d. per cwt., and the index figure declined one point to the level of 60 per cent. above pre-war. Barley advanced by 2d. and oats by 1d. per cwt., the relative index figures moving upwards by

one point in the case of barley to 37 per cent. above the base years and downwards by 4 points to 16 per cent. in the case of oats. The decline in the latter instance is due to the relatively greater increase in the price of oats in the corresponding months of the base years 1911–13.

Live Stock

A fall of 6d. per live cwt. in the price of fat cattle was recorded in February and, aided by a rise of 5d. per live cwt. in February, 1911–13, caused the index figure to fall three points to the level of 30 per cent. above pre-war as compared with 47 per cent. a year earlier and 53 per cent. in February, 1925. The price of fat sheep declined by ¼d. per lb. and with a rise of ½d. in the base years the index figure was 13 points below the January figure of 57 per cent. above pre-war. Both bacon pigs and porkers were reduced in price by about 2d. per 14 lb. stone, estimated dressed carcass weight, and the corresponding index figures were seven points lower in each case at 63 per cent. and 75 per cent. respectively above 1911–13. Dairy cattle showed a further decline of 13s. per head and were thus only 26 per cent. dearer than pre-war, while store cattle improved a little to 30 per cent. above the level of the base years. Store sheep and store pigs appreciated somewhat in price during February, but there was a relatively greater increase in the corresponding period of 1911–13 and the index figures are, therefore, somewhat lower at 48 per cent. and 125 per cent. respectively above pre-war.

Dairy and Poultry Produce

Butter and cheese were unchanged in price on the month, but changes in the base prices in February, 1911-13, caused the index figures to vary a few points, butter moving from 37 to 40 per cent. and cheese declining from 38 to 36 per cent. above the pre-war level. The average price of milk sold under contract in the Manchester area was somewhat lower than in January and as a result a fall of three points is recorded in the index figure for milk. Eggs were almost the same price as in the previous month, but a considerable decrease in price occurred in February of the base years and the index figure shows a sharp rise of 16 points to a level of 62 per cent. above pre-war; at this figure eggs were 10 points lower than a year earlier. Poultry were little altered at 39 per cent. above the base years 1911-13.

Other Commodities

The prices of potatoes and hay were practically the same as in January, and a fall of one point in the index figure brought potatoes to 94 per cent. above pre-war prices as compared with 49 per cent. a year ago. Hay was actually cheaper than in 1911-13. Vegetables were a little cheaper on the month at 41 per cent. above the level of the base years, or six points lower than in the previous month. Wool remained 32 per cent. dearer than pre-war, the slight increase in price in February being proportional to the increase in the corresponding period of 1911-13.

Index numbers of different commodities during recent months and in February, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926			1927	
	Feb.	Feb.	Nov.	Dec.	Jan.	Feb.
Wheat	83	60	66	61	61	60
Barley	59	19	35	31	36	37
Oats	42	27	20	17	20	16
Fat cattle	53	47	31	28	33	30
Fat sheep	100	50	43	44	57	44
Bacon pigs	62	89	71	63	70	63
Pork pigs	60	89	76	72	82	75
Dairy cows	50	40	34	30	28	26
Store cattle	46	37	22	21	29	30
Store sheep	100	53	42	41	55	48
Store pigs	48	121	135	115	135	125
Eggs	62	72	60	46	46	62
Poultry	56	50	49	49	38	39
Milk	84	74	64	65	65	62
Butter	62	47	47	40	37	40
Cheese	50	78	28	28	38	36
Potatoes	144	49	113	110	95	94
Hay	—	4	4	2	—1*	—2*
Wool	119	45	31	29	32	32

* Decrease.

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Stud Goat Scheme, 1927–28

THE scheme operated by the Ministry and the British Goat Society, with the object of enabling goat-keepers of the small-holder and cottager class to secure the services of first-grade stud goats, for breeding purposes, at a maximum fee of 5s., will be continued in 1927. Persons desirous of entering their stud goats under the scheme should apply to the Honorary Secretary of the British

Goat Society, 10 Lloyd's Avenue, E.C. 3, who will be pleased to furnish full information. Entries will not be considered after June 1, on, and subsequent to, which date the goat submitted for approval must be at the centre in which it is proposed to stand at stud, so that the animal may be available for inspection. A goat accepted must remain at the approved centre, unless permission for its removal (under the same ownership) to another centre be granted by the Society. Applications for registration are invited from any owners of eligible stud goats, whether members of the Society or not.

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Post-Graduate Agricultural Scholarships

PARTICULARS have been issued by the Colonial Office, the Ministry of Agriculture and Fisheries, the Board of Agriculture for Scotland and the Empire Cotton Growing Corporation of the following post-graduate scholarships which they will award during the current year, and which will be tenable from October 1 next for one, two, or three years, as the case may be:—

Colonial Office.—It is intended to award from 16 to 18 post-graduate scholarships in agriculture and agricultural science, *at any rate until the year* 1933 *inclusive*, provided that a suitable number of candidates present themselves. The question of the continuance of the scheme will be examined in 1932. The object of these scholarships is to create a pool of properly qualified candidates from which vacancies in the Colonial Agricultural Departments can be filled. Candidates should, if applying for a research or specialist scholarship, hold an honours degree in pure science of a standard not lower than Part II of the Cambridge Natural Sciences Tripos; or, if applying for a general agricultural scholarship, hold a degree or diploma in agriculture or natural sciences (of which botany must be one) entailing not less than a three-years' course of study at a university or agricultural college. A candidate may apply before taking his final examination.

A scholarship will usually be tenable for two years, the first being spent in this country and the second at the Imperial College of Tropical Agriculture, Trinidad, or at some similar institution abroad; but scholarships for one year only may be granted at the discretion of the Secretary of State. The value of a scholarship is £250 per annum, from which the fees of training institutions must be paid. Passage expenses overseas are provided in addition to the scholarship, together with the cost of travelling, if required, whilst abroad, and of approved

books. Inquiries for fuller particulars and for forms of application should be addressed in writing to the Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W. 1. Completed applications should be received by the Private Secretary before June 15, 1927.

Ministry of Agriculture and Fisheries and Board of Agriculture for Scotland.—(1) *General Agricultural Scholarships.*—Five of these scholarships will be awarded. Their object is to train agricultural students who propose to take up posts in this country as agricultural organizers, teachers or lecturers in agriculture (agriculture includes horticulture, dairying, poultry work, etc.). Candidates must be British born, and should be graduates of a university or be otherwise qualified and must have some experience of practical farming. Candidates may apply before taking their degree or diploma examination. The value of the scholarships is normally £200 per annum, and expenses of travelling, laboratory fees, etc., are met. The scholarship is awarded for one year in the first instance, renewable for a second year on satisfactory reports on the scholar being received. The first year is normally spent in this country and the second year abroad. The amount of the scholarship maintenance allowance is increased in the second year where necessary.

No guarantee of employment at the conclusion of the scholarship can be given, but agricultural colleges and county councils in filling vacancies on their staffs may be expected to give preference to those who have held these scholarships.

(2) *Agricultural and Veterinary Research Scholarships.*—Seven of these scholarships will be awarded. Their object is to train students for a career as agricultural research or advisory worker. Candidates must be graduates with honours in science of a British university or equivalent qualifications. The value of the scholarships is £200 per annum; they are tenable for three years, one of which is usually spent abroad, in which case the maintenance allowance is increased, if necessary, and expenses of travelling, laboratory fees, etc., are met. No guarantee of employment at the conclusion of the scholarship can be given, but it is usual for agricultural research institutes and advisory centres to fill any vacancies occurring in their junior staff from among these scholars.

Forms of application for general agricultural scholarships and agricultural and veterinary research scholarships may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1, or from the

Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh, according to the country in which the candidate resides. Completed applications should be received on or before June 30, 1927.

Empire Cotton Growing Corporation.—Post-Graduate Studentships.—The Corporation intend to award in July next not more than 12 studentships tenable for one year, each of the value of £250, with certain additional allowances for travelling expenses, lecture fees and books. The studentships are intended to provide opportunity either for additional training in research methods in, or for the advanced study of, plant physiology, genetics, mycology, entomology and other allied subjects which relate to the utilization of the soil and thus to improve the qualifications of those who are likely to seek employment in cotton-growing countries, either as botanists or in other specialized work or in agricultural administration or inspection.

Candidates must be men of British nationality. Applicants for senior studentships must be graduates who since taking their degree have had at least a year's training in research methods, or have done a year's post-graduate work in agriculture, or taken other advanced post-graduate course. Junior studentships are intended to assist men who as a rule should have passed all examinations for, and be otherwise qualified to take, a degree, but are unable without financial assistance to fulfil the post-graduate requirements for senior studentships.

All candidates must pass a medical examination, and candidates for senior studentships must be prepared to spend their studentship year at some institution abroad.

Particulars and forms of application may be obtained from the Secretary, Empire Cotton Growing Corporation, Millbank House, Millbank, London, S.W. 1. All letters should state whether the inquiry relates to a junior or a senior studentship. Forms of application must be returned so as to reach the Secretary not later than June 21, 1927.

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Travelling Research Fellowships

THE Ministry has awarded the following travelling research fellowships to agricultural research workers in the financial year 1927:—

(1) A Fellowship of £250 to Mr. E. T. Halnan, of the Cambridge Animal Nutrition Institute, to enable him to attend the World's Poultry Congress at Ottawa and to visit Nutrition Research Centres in the United States.

(2) A Fellowship of £80 to Mr. T. J. Jenkin, of the Welsh Plant Breeding Station, Aberystwyth, for a visit to Norway and Sweden to study plant breeding methods and technique.

(3) A Fellowship of £40 to Mr. H. G. Sanders, of the Cambridge Animal Nutrition Institute, for a visit to Denmark and Sweden to study Live Stock Improvement Schemes, especially in regard to dairy cattle.

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Grants for Attendance at International Conferences

THE Ministry has awarded the following grants to enable the workers mentioned to attend at the following conferences :—

(1) First International Congress of Soil Science, Ithaca, U.S.A., June 13 to July 22, 1927. Grants of £55 to—

Prof. N. M. Comber, Department of Agriculture, Leeds University
Dr. E. M. Crowther, Rothamsted Experimental Station.
Dr. B. A. Keen, Rothamsted Experimental Station.
Mr. H. J. Page, Rothamsted Experimental Station.
Prof. G. W. Robinson, University College of N. Wales, Bangor.

(2) Fifth International Conference on Genetics, Berlin, September 11 to 18, 1927. Grants of £30 to—

Mr. H. Hunter, Cambridge Plant Breeding Institute.
Mr. A. E. Watkin, Cambridge Plant Breeding Institute.

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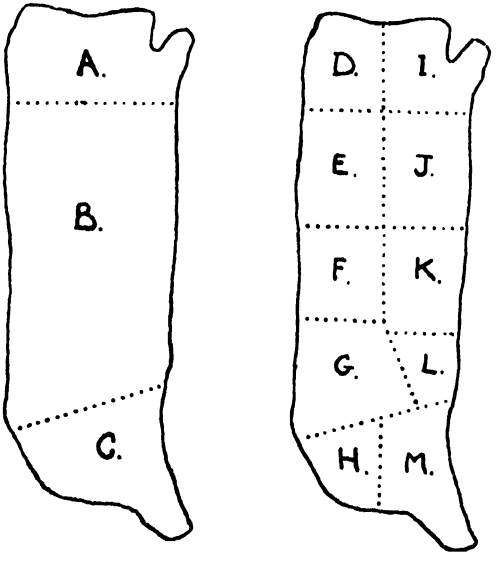
Pig Carcasses for Wiltshire Bacon

IN the printing of the article on "Pig Carcasses for Wiltshire Bacon," in the March issue of the JOURNAL, the key to the diagram, shown in Fig. 1 (p. 1096), was omitted. The diagram and key are reproduced below :—



A Fore-end.
B Middle.
C Gammon.

D Collar.
E Rib Back.
F Short Back.
G Long Loin.
H Corner Gammon.
I Forehock.
J Thick Streaky.
K Thin Streaky.
L Flank.
M Gammon Hock.

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on February 21, at 7 Whitehall Place, S.W. 1, the chairman, Lord Kenyon, presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions :—

Bedfordshire and Huntingdonshire.—An Order continuing from March 1 until further notice the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The rates in question are in the case of male workers of 21 years of age and over 30s. 6d. per week of 48 hours in winter and 50 hours in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, and in the case of female workers of 18 years of age and over 6d. per hour for all time worked.

Berkshire.—An Order varying, as from February 28, the overtime rates of wages for male workers of 17 years of age and over, the rate in the case of workers of 21 years of age and over being increased from 8d. to 8½d. per hour. The Order also continues the general minimum rates unchanged until October 11, 1927 (the rate for male workers of 21 years of age and over being 30s. for a week of 50 hours).

Cambridgeshire and Isle of Ely.—An Order continuing from March 1 (when the existing rates are due to expire) until October 31, 1927, the existing minimum and overtime rates of wages for male and female workers, with amendments in the case of male workers under 19 years of age. The minimum rate, in the case of male workers of 21 years of age and over employed wholly or mainly as horsemen, cowmen or shepherds, is 37s. per week of the hours necessary for the performance of the customary duties of workers so employed, and in the case of other male workers of 21 years of age and over 30s. per week of 51 hours, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day, and Good Friday. In the case of female workers of 18 years of age and over the minimum rate is 5½d. per hour, with overtime at 7d. per hour.

Dorset.—An Order continuing as from February 27 until August 27, 1927, the existing minimum and overtime rates of wages for male and female workers. In the case of male workers of 21 years of age and over the minimum rate is 30s. per week of 51 hours in summer and 48 hours in winter, with overtime at 8d. per hour, and in the case of female workers of 15 years of age and over 5d. per hour, with overtime at 6d. per hour.

Kent.—An Order continuing as from March 2 for a period of 12 months the existing minimum and overtime rates of wages for male and female workers. The minimum rate, in the case of male workers of 21 years of age and over, employed wholly or mainly as horsemen, stockmen, or shepherds, is 33s. per week of 52 hours, and in addition 8d. per hour for all employment on customary duties in excess of 52 hours but not exceeding 60 hours in any week, with overtime for employment on customary duties at 9d. per hour and when employed on other duties 9d. per hour on weekdays and 10d. per hour on Sundays. In the case of other male workers of 21 years of age and over the minimum rate is 32s. 6d. per week of 52 hours in summer and 48 hours in winter, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays, and in the case of female workers of 18 years of age and over 5½d. per hour, with overtime at 6½d. per hour on weekdays and 7d. per hour on Sundays.

Lincolnshire, Kesteven and Lindsey Divisions.—An Order continuing as from March 7 until March 4, 1928, the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rate, in the case of male workers of 21 years of age and over employed wholly or mainly as waggoners, is 39s. per week of 52 hours in summer and 48 hours in winter, and such additional hours as may be required for the performance of customary duties in connexion with the care of horses up to 61 hours from October 15 to May 13 and up to 58 hours during the remainder of the year. In the case of male workers of 21 years of age and over, employed wholly or mainly as shepherds, the minimum rate is 37s. per week of 52 hours in summer and 48 hours in winter, and such additional hours as may be required for the performance of customary duties in connexion with the care of sheep up to 55 hours in summer and 56 hours in winter. Additional payments are to be made in respect of the lambing season. In the case of male workers of 21 years of age and over, employed wholly or mainly as stockmen, the minimum rate is 38s. per week of 52 hours in summer and 48 hours in winter, and such additional hours as may be required for the performance of customary duties in connexion with the care of stock up to 56 hours in summer and 58 hours in winter. The minimum rate in the case of other male workers of 21 years of age and over is 32s. per week of 48 hours in winter and 52 hours in summer, with overtime in the case of all classes of male workers at 9½d. per hour on weekdays and 11½d. per hour on Sundays. In the case of female workers of 17 years of age and over the minimum rate is 5½d. per hour for all time worked.

Monmouthshire.—An Order continuing as from March 16 for a period of 12 months the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The rates in question are—in the case of male workers of 21 years of age and over, 32s. per week of 48 hours in winter and 50 hours in summer, with overtime at 9½d. per hour on weekdays and 11½d. per hour on Sundays, and in the case of female workers of 17 years of age and over, 6d. per hour for all time worked.

Northumberland.—An Order to come into operation at noon on May 13 (when the existing rates are due to expire) and to continue in force until noon on May 13, 1928, fixing minimum and overtime rates of wages for male and female workers. The minimum rates in question are in the case of male workers of 21 years of age and over employed wholly or mainly as stewards, horsemen, cattlemen, stockmen, or shepherds and hired by the week or longer period, 39s. for householders and 36s. for workers who are not householders (instead of 40s. and 37s., respectively, as at present), and in the case of other classes of male workers (other than casual workers), 32s. (instead of 33s. as at present) per week of 48 hours in winter and 52½ hours in summer, with overtime for all classes above mentioned at one and a-quarter times the general minimum time rate on weekdays, and one and a-half times the general minimum time rate on Sundays. The minimum rate for casual male workers of 18 years of age and over is 7½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, except in the case of casual workers, where the minimum rate is 3d. per hour, the overtime rate in each case being 1d. per hour above the general minimum time rate otherwise applicable.

Worcestershire.—An Order continuing as from March 6 until March 5, 1928, the existing minimum and overtime rates of wages for male and female workers. The minimum rates are in the case of male workers of 21 years of age and over, 30s. per week of 50 hours in summer and 48 hours in winter, with overtime for stockmen, shepherds, and waggoners at 7d. per hour up to 53 hours in summer and 51 hours in winter, and 9d. per hour in excess of those hours, and for other male workers, 9d. per hour for all overtime employment. In the case of female workers of 18 years of age and over, the minimum rate is 4½d. per hour, with overtime at 5½d. per hour.

Glamorganshire.—An Order to come into operation on March 2 (when the existing rates are due to expire) and to continue in force until March 1, 1928, fixing minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are 40s. per week of 60 hours for workers employed wholly or mainly as stockmen, cattlemen, cowmen, horsemen, shepherds, or bailiffs, with overtime at 11d. per hour, and in the case of other male workers, 36s. per week of 52 hours in summer and 48 hours in winter (instead of 50 and 48 hours respectively, as at present), with overtime at 10d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour, with overtime at 7d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending March 15, legal proceedings were instituted against eight employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board for workers in agriculture. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			Workers concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Hereford ..	Hay		—		3	18	0	4	13	0	1
Monmouth	Abergavenny	0	6	0		—	—	49	11	6	3
,,	Monmouth ..	1	4	0	3	2	6	77	16	0	5
Devon ..	Holsworthy ..	0	5	0	0	5	0	33	17	8	1
,, ..	,, ..	0	5	0	0	5	0	25	18	0	1
,, ..	,, ..	0	5	0	0	5	0	50	12	0	1
Hants ..	Basingstoke ..	6	0	0	9	9	0	18	14	0	2
Suffolk ..	Framlingham	2	0	0	0	5	7	12	10	0	1

In regard to the case heard at Monmouth, an inspector visited the employer concerned in February, 1926, and explained that the Monmouthshire Agricultural Wages Committee had prohibited the reckoning of any benefit or advantage as part payment of minimum rates of wages, and that if a worker was provided, for instance, with board and lodging the matter must be treated as a separate transaction, as no deduction on that account could be made from payment of wages. A recent re-inspection revealed the fact that, for the first week after the inspector's visit, wages were paid in accordance with the Orders, but that subsequently the employer reverted to his former method of payment, which resulted in an infringement of the Act, inasmuch as, even if a reasonable allowance could have been legally made for benefits provided, the workers would still have received less than the equivalent of the minimum wage.

Foot-and-Mouth Disease.—No fresh centre of disease has been discovered since the issue of the March number of the JOURNAL; but two further outbreaks have been confirmed in existing infected areas. The first was confirmed at Tamworth, Staffs, on February 24; and the other at Little Tey, Colchester, Essex on the March 4

Twenty-one outbreaks have been confirmed in all since January 1 last, involving eight counties, and the slaughter of 1,004 cattle, 565 sheep, and 348 pigs.

* * * * * *

Failure to Render Agricultural Returns.—As a result of the passing of the Agricultural Returns Act, 1925, the annual agricultural returns of the acreage of crops and number of live stock became compulsory. Comparatively few occupiers failed to render their returns in 1926, but proceedings were taken against four occupiers, and fines varying from £1 to £3 were imposed in each case.

* * * * * *

Leaflets Issued by the Ministry.—Since the date of the list given in the March (1927) issue of this JOURNAL, p. 1162, the following leaflets have been issued :—

Rewritten :—

No. 16. Apple Sucker.

Revised :—

No. 308. Plum Aphides.

Amended :—

No. 279. Technical Advice for Farmers.

* * * * * *

NOTICES OF BOOKS

Inorganic Plant Poisons and Stimulants. By Winifred E. Brenchley, D.Sc., F.L.S. (Cambridge : The University Press. Price 10s. 6d. net.)

It is becoming increasingly evident that the reactions of animals and plants to chemical reagents and to physical conditions may be very pronounced, even when the reagents are present in extremely dilute solutions, or the differences in physical conditions are only measurable by most exact methods. The reaction of plants to minute traces of such mineral elements as occur exceptionally in quantity in natural soils has been investigated by many research workers with varying results. In 1914, Dr. Brenchley published a concise account of the work done up to that date, and a second edition of her book has just appeared in which new results are incorporated, especially those concerning Manganese and Boron. The methods employed can be classified under the four headings of water cultures, sand cultures, soil cultures in pots, and field experiments. It is doubtful if sufficient is yet known to justify the use in practical agriculture of any of the inorganic substances investigated. With copper compounds, stimulation may be manifest at low concentrations and poisoning at higher concentrations. With zinc compounds, it appears that stimulation occurs in some species of higher plants in soil but not in water cultures. No definite evidence of stimulation has yet been obtained with any arsenic compound, however great the dilution at which it was applied. Boron, below a certain limit of concentration, exercises a favourable influence upon plant growth, and for some species, especially of the pea family, small quantities of Boron appear to be as essential for healthy development as any of the more abundant elements generally regarded as nutritive in function. The concentrations of Boron which cause stimula-

tion are remarkably low. Thus, with peas, concentrations from 1/100,000 downwards to 1/20,000,000 caused improvement in growth. Manganese, again, exerts a toxic influence on plants if it is available in too great amount, but small quantities appear to cause a very general stimulation of growth. It is probable that researches with Boron and Manganese are most likely to yield practical results, although the technique of applying to economic farming the favourable results obtained under easily controlled laboratory conditions has still to be found.

Rainfall Atlas of the British Isles. (Published by the Royal Meteorological Society, 49 Cromwell Road, London, S.W. 7. Price 15s. net.)

No apology is needed for the review in this JOURNAL of a book dealing with rainfall. The importance of accurate rainfall data, both in the practical business of farming and in scientific research in agriculture, needs little stress. Different crops require different amounts of moisture at their various growth stages; rainfall at certain times of the year may hinder farming operations, such as ploughing, seeding and harvesting, and may spoil a crop after harvesting; and rainfall has an influence on the prevalence of pests and diseases of crops and on the action of manures.

The volume under review is exceedingly well produced, and will be valuable in any general surveys of the effect of rainfall on the agriculture of the country, and in the first stages of any detailed surveys on the subject. Three full-page maps show the rainfall distribution in the "average" year, in a very wet year (1872), and in a very dry year (1887). A series of 56 half-page maps show, for each year from 1868 to 1923, the distribution of rainfall expressed as a percentage of the average; 12 full-page maps show the distribution of average rainfall for each month of the year. An introduction, by Dr. H. R. Mill, gives a history of the British Rainfall Organization, and an account of the methods used in the construction of the maps. The atlas shows that rainfall increases from east to west, and is highest in the neighbourhood of the highest land. The normal annual rainfall for England and Wales is 35·23 inches; but in the Snowdon district an average of over 200 inches is reached, and in Borrowdale an average of over 180 inches; the average falls to 20 inches in the south-east of Essex and the north-east of Kent. In the wet year of 1872, the rainfall for England and Wales was 50·8 inches, and in the dry year of 1887, 26·1 inches. In the former year a fall of 244 inches was reached in Cumberland, and in the latter year the fall for the Thames estuary was less than 15 inches. The sequence of wet and dry years is very irregular; thus from 1868 onwards there were two wet years, two dry, one very wet, two rather dry, nine consecutive wet, two dry, etc.

The normal rainfall of every month is distributed in substantially the same way as the normal rainfall of the year. For the east and south the rainiest month is October; for the west and north December or January; for the whole of England and Wales the driest month is April (followed closely by May and June), and the wettest October (followed closely by December).

Politics and the Land. By C. Dampier-Whetham, M.A., F.R.S. (Cambridge University Press. Price 6s. net.)

In this little book of 200 pages, the chief results of recent inquiry regarding the state of agriculture and the future of the land are brought under review. The author, impressed by the fact that there is no general understanding of the economic conditions which determine the methods of British farming, or of the causes which produce agricultural prosperity or adversity, makes his own attempt to understand

these conditions and causes, and sets out in the clearest possible style the facts and inferences which have helped him in his study.

Regarding agricultural depression, he shows that, when the general price level is falling, depression is inevitable. Neither skilful cultivation, co-operative marketing, nor import duties can prevent it, though they may mitigate its effects. The farmers' troubles, he concludes, are caused by unremunerative prices, as has been consistently and continually pointed out by the National Farmers' Union.

"The only complete cure would be a stabilization of the general price level, for the chief cause of depression is not agricultural or economic, but monetary." The author does not decry partial remedies; indeed, he thinks that alleviation may be all that is possible "until Nature in the form of a new goldfield or Man in the form of a refusal to produce enough food at present rates" effects a radical cure.

He points out that the farmer is less able to bear a continued fall in prices than other producers because of the length of time his operations take. His costs begin months before he sells his produce; consequently falling prices mean adversity. It is only when prices are rising that a farmer can look for prosperity.

On a grass dairy farm the economic lag is only about seven months, as compared with double that time on an arable farm. Hence is seen the sound economic reason which underlies the general opinion that grass land is safer than arable land.

The book can be recommended with confidence to all interested in agriculture.

The Principles of Dairy-Farming. By G. H. Garrad, N.D.A., *Farmer and Stockbreeder* Manuals. (London: Ernest Benn, Ltd. Price 7s. 6d. net.)

This handbook of 200 pages is a concise review of the chief factors which influence success in modern dairy-farming. The suitability of a farm for milk production, and the breeding and management of young stock, is shown in a practical manner: the chief aspects, also, of milk production and the feeding of dairy cows are brought up-to-date, supported by reference to recent experiments and publications on the subject. The author comments on many controversial matters, *e.g.*, the use of roots, milking thrice daily, breeding and the use of minerals, whilst the significance of clean milk production and its influence on consumption by the public is discussed. The book should be of service to milk producers and students, also members of the general public who may wish to gain an insight into the many aspects of this branch of agriculture.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Duhamel du Monceau.—A Practical Treatise of Husbandry: Wherein are contained many useful and valuable experiments and observations in the New Husbandry, collected during a series of years. Also the most approved Practice of the best English Farmers in the Old Method of Husbandry. (491 pp.) London, 1759. [63 (022); 63 (42).]

King, F. H.—Farmers of Forty Centuries, or Permanent Agriculture in China, Korea and Japan. (379 pp.) London: Jonathan Cape, 1926, 12s. 6d. [63 (5).]

Fitzrandolph, Helen E., and *Hay, M. Doriel.*—The Rural Industries of England and Wales: A Survey made on behalf of the Agricultural Economics Research Institute, Oxford. Vol. II.—

Osier Growing and Basketry and Some Rural Factories. (159 pp. + 12 pl.) London: Oxford University Press, 1926, 5s. [63.193; 63.3412.]

Russell, Sir E. J.—Soil Conditions and Plant Growth (5th Edition). The Rothamsted Monographs on Agricultural Science. (516 pp.) London: Longmans, Green & Co., 1927, 18s. [63.115; 63.161.]

Brenchley, W. E.—Inorganic Plant Poisons and Stimulants. (2nd Edition.) (134 pp.) Cambridge University Press, 1927. 10s. 6d. [58.11; 63.168.]

Cave, H.—Fertilizers: Their Sources, Manufacture and Uses. (116 pp.) London: Pitman, 1926, 3s. [63.16.]

Cutler, D. Ward.—Evolution, Heredity, and Variation. (147 pp.) London: Christophers, 1925, 4s. [575.1.]

Royal Meteorological Society.—Rainfall Atlas of the British Isles. (12 pp. + 44 pl.) Published by the Society at 49, Cromwell Road, South Kensington, S.W. 7, 1926, 15s. [912; 551.5.]

Horticulture and Fruit

Watson, Margaret J. M.—The Home Preservation of Fruit and Vegetables. (142 pp. + 12 pl.) Oxford University Press; London: Humphrey Milford, 1926, 6s. [664.84; 664.85.]

Department of Scientific and Industrial Research.—Food Investigation Special Report No. 27: Temperature Conditions in Refrigerated Holds carrying Apples. By *A. J. M. Smith.* (52 pp.) London: H.M. Stationery Office, 1926, 1s. 6d. [664.8.]

Department of Scientific and Industrial Research.—Food Investigation Special Report No. 29: Temperature Conditions in Small Cold Storage Chambers containing Fruit. By *A. J. M. Smith.* (37 pp.) London: H.M. Stationery Office, 1926, 1s. [664.8.]

Thomas, H. H.—Pruning made Easy: How to Prune Rose Trees, Fruit Trees and Ornamental Trees and Shrubs. (184 pp. + 8 pl.) London: Cassell & Co., 1927, 2s. 6d. [63.41-195; 63.524; 63.522.]

Thomas, H. H.—Home-Grown Vegetables: The Amateur's Guide to Their Cultivation. (184 pp. + 8 pl.) London: Cassell & Co., 1927, 2s. 6d. [63.511.]

Thomas, H. H.—An Easy Guide to Gardening. (184 pp. + 8 pl.) London: Cassell & Co., 1927, 2s. 6d. [63.5.]

Thomas, H. H.—Rock Gardening for Beginners. (184 pp. + 8 pl.) London: Cassell & Co., 1927, 2s. 6d. [63.52.]

Lambert, N., and *Thomas, H. H.*—Sweet Peas for Amateurs. (184 pp. + 8 pl.) London: Cassell & Co., 1927, 2s. 6d. [63.522.]

Thomas, H. H.—500 Popular Flowers and How to Grow Them. (184 pp. + 8 pl.) London: Cassell & Co., 1927, 2s. 6d. [63.522.]

Plant Pests and Diseases

South-Eastern Agricultural College, Wye.—Bulletin No. 5: Some Soil Insects and Their Treatment. By *F. V. Theobald.* (6 pp.) Wye, 1927, 6d. [63.27.]

Appel, Dr. Otto.—Taschenatlas der Krankheiten der Zuckerrübe. (22 pp. + 20 pl.). Berlin: Paul Parey, 1926. [63.24-33; 63.27-33.]

Wardlaw, C. W.—Lanarkshire Strawberry Disease: A Report for the Use of Growers. (38 pp. + 4 pl.) University of Glasgow, 1926, 2s. [63.24-41; 63.41 (c).]

Department of Scientific and Industrial Research.—Food Investigation Special Report No. 28: Bitter Pit in Apples. A Review of the Problem. By *A. J. M. Smith.* (24 pp. + 2 pl.) London: H.M. Stationery Office, 1926, 1s. [63.21.]

Iowa Agricultural Experiment Station.—Research Bulletin No. 96: The Extent to which Weeds Modify the Transpiration of Cereals. (pp. 209-240.) Ames, 1926. [63.259.]

Live Stock

Staffordshire Farm Institute, Penkridge.—Iodine in Animal Nutrition: A Three Years' Trial. (7 pp.) 1926. [612.394; 63.60432.]

Ohio Agricultural Experiment Station.—Bulletin No. 395: Mineral and Vitamin Requirements of Pigs, with Special Reference to the Effect of Diet on Bone Development. (229 pp.) Wooster, 1926. [612.394; 63.64: 043.]

Iowa Agricultural Experiment Station.—Research Bulletin No. 94: The Salt Consumption of Sheep: Fattening Lambs. (pp. 129 176.) Ames, 1926. [63.631: 043.]

Dairying

Prewett, F. J.—The Marketing of Farm Produce. Part II: Milk. (84 pp.) Oxford: at the Clarendon Press, 1927, 3s. 6d. [381; 63.70: 38; 63.716.]

Palmer, Leroy S.—Laboratory Experiments in Dairy Chemistry. (84 pp.) New York: John Wiley; London: Chapman & Hall, 1926, 4s. 6d. [54; 543.2.]

Iowa Agricultural Experiment Station.—Research Bulletin No. 95: Influence of Carbon Dioxide upon Quality and Keeping Properties of Butter and Ice Cream. (pp. 177-208.) Ames, 1926. [63.721; 63.715; 63.725.]

Veterinary Science

Ministry of Agriculture and Fisheries.—Second Progress Report of the Foot-and-Mouth Disease Research Committee. (117 pp.) London: H.M. Stationery Office, 1927, 3s. [619.2 (d).]

Poultry

United States Department of Agriculture.—Farmers' Bulletin 1508: Poultry Keeping in Back Yards. (28 pp.) Washington, 1926. [63.651.]

Economics

Cambridge School of Agriculture, Farm Economics Branch.—Report No. 5 (February, 1927): A Successful Norfolk Poultry Farm, 1922–26. *R. McG. Carslaw.* (19 pp.) Cambridge: School of Agriculture, 1927, 1s. (post free). [63.65 (42).]

Scotland, Board of Agriculture.—Report of Committee on Questions of Farm Accounting and Economics. (34 pp.) Edinburgh: H.M. Stationery Office, 1926, 9d. [657.]

Dampier-Whetham, C.—Politics and the Land. (215 pp.) Cambridge: University Press, 1927, 6s. [338.1.]

Larmer, F. M.—Financing the Live Stock Industry. (327 pp.) New York: Macmillan, $2.50; London: Allen & Unwin, 1926, 10s. [332.71 (73); 63.6 (73).]

Pröhl, Dr. Hans.—Die Deutsche Rentenbank-Kreditanstalt (Landwirtschaftliche Zentralbank) ihr aufbau und ihre Funktionen. (208 pp.) Berlin: Robert Gürgens, 1926. [332.71 (43).]

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NOTES FOR THE MONTH

THE Linlithgow Committee, after surveying the whole marketing field, made the following recommendation in its final report* :—

Markets and Fairs in England and Wales

"During the course of our inquiry we have been struck by the lack of readily available information regarding the markets of the country. This appears to be due to the fact that there is no general body of legislation on the subject; many markets owe their origin to early charters, others are controlled by local authorities under private Acts of Parliament, while others have been established under the general powers of the Public Health and other Acts. As a result, there is no Government Department which is concerned to consider the relation of local markets to the food supply of the country, their influence on prices, or their general suitability from the point of view either of the consumer or the producer. The Ministry of Health in England and Wales and the Department of Health in Scotland only come into the picture, we understand, in connexion with the powers of local authorities (mainly in regard to sanitation and finance) as prescribed by certain Acts of Parliament, and cannot deal in any way with the wider aspect of the question to which we have referred above. As a preliminary step to the further consideration of this question, we think it desirable that the Government Departments concerned should collect and publish information as to the control and ownership of markets and any relative information likely to be useful."

* *Departmental Committee on Distribution and Prices of Agricultural Produce : Final Report*, p. 41. [Cmd. 2008.] H.M. Stationery Office. Price 1s. net.

In furtherance of this recommendation, a survey of the agricultural markets and fairs in England and Wales has been undertaken by the Ministry in connexion with, and complementary to, its investigations into marketing. Sufficient progress has been made with this survey to enable a preliminary report to be prepared.* This presents a general view of markets and market conditions in this country and is intended to serve as a background to later and more detailed reports on this subject.

In the introductory chapter of this first report the historical and legal foundations of markets and fairs, and the statutes and regulations affecting their administration and control, are briefly reviewed. Since 1847, no general enactment regulating markets has been made; it is not surprising, therefore, that little uniformity, and much that is anomalous, is present in the mass of laws and statutes which govern the markets of to-day.

In subsequent chapters, the markets are classified according to the commodities sold and the methods of sale. Wholesale markets are divided, broadly, into markets in producing areas and markets in consuming centres. The former are subdivided into (*a*) fruit and vegetable markets, (*b*) egg and poultry markets, (*c*) cheese and butter markets, (*d*) corn and provender markets, and (*e*) wool auctions. The latter are resolved into three main classes: (*a*) fruit, flower and vegetable markets, (*b*) fish and poultry markets, and (*c*) meat markets. From views expressed by competent authorities, the chief features to be considered in the provision of wholesale market facilities are summarized.

Live-stock markets, on account of their outstanding importance to the farming community, are considered in greater detail. Private treaty is still the main method of business in a few large fat-stock markets, which are mainly dealers' clearing-houses, and also in the large store-stock markets, especially those to which large numbers of Irish cattle are consigned. Four kinds of live-stock auctions are distinguished according to their size and location, and the superiority of large over small markets from the standpoint of equipment and competitive sale is stressed. The desirable features of a well-planned live-stock market are indicated, and the case for the abolition of live-stock street markets, where they exist, is stated. The powers of control exercised by public authorities and private

* *Markets and Fairs in England and Wales (Part I).* Economic Series, No. 13. H.M. Stationery Office. Price 6d. net.

owners over auction markets are discussed, and it is shown that the powers of local authorities are often restricted and may lead both to an excessive number of auctioneers and to a clashing of sales.

Since the main weakness of the present system in England is the unnecessary number of small separate auctions, whether for the sale of live stock, eggs, poultry or wool, the suggestion is put forward that the four parties mainly concerned—namely, farmers, auctioneers, buyers and market owners—should get together and form district committees for the purpose of examining the markets in their respective areas and agreeing on some rearrangement which will have the effect of eliminating the smaller markets and strengthening the larger. The suggestion is also made that there would appear to be a reasonable case for the greater exercise of central, *i.e.*, national, authority in regard to market problems of more than local significance, including the economic development of markets generally.

The importance of markets, not only for their functions in the marketing system, but equally for their reactions on agriculture, is emphasized in the concluding chapter of the Report. Markets are institutions of great antiquity, but they have still a large part to play in the vast trade in agricultural products which is transacted in this country.

With the aid of the grant recently made to the Ministry by the Empire Marketing Board, the report is being issued at the nominal price of 6d. net. It is freely illustrated, and should be of service not only to all concerned with the control and administration of markets, but to producers, distributors and others interested in agricultural marketing. A knowledge of the markets of the country is essential if the methods of marketing agricultural produce are to be fully understood.

A description of Dresden markets, which are generally quoted on the Continent as the embodiment of all that is best in live-stock markets and abattoir construction and design, and interesting notes on markets in other countries are contained in an appendix to the report.

* * * * * *

Rothamsted Conference on Cultivation

ANOTHER of the well-known periodical conferences was held at the Rothamsted Experimental Station on March 22, the subject on this occasion being cultivation. Sir Daniel Hall occupied the chair in the absence, through illness, of the Rt. Hon. Lord Bledisloe. In his introductory remarks, the CHAIRMAN compared the present monetary relationship between wheat and wages with that of pre-war days. The problem before the farmer was to adjust the methods of the farm to a period of dear labour and comparatively low returns for his produce.

Dr. B. A. KEEN defined the objects of cultivation as (1) the elimination of weeds, (2) the control of moisture, and (3) the formation of tilth. Tillage was the most costly item of farm expenditure, and the surest way to reduce it was by means of labour-saving implements and machinery. Rotary cultivation was recently compared at Rothamsted with flat and ridge cultivation in the growing of swedes. The stubbles were ploughed in the autumn in the ordinary way. In spring, the portions intended for flat and ridge work were cross-ploughed and subsequently worked down to the requisite tilth. In the case of the other portion, cross-ploughing was omitted, a seed bed being formed at one operation by a rotary tiller.

The rotary tiller left the soil in a finely comminuted state, puffy and spongy. After a roller had been passed over the ground, the seed was sown at an even depth. Germination and early growth were good, and, for some time, this plot promised best of all. Then, suddenly, the ground set hard; growth was checked; and the final crop was inferior to that obtained by ordinary methods.

No farmyard manure was used in the trial. It is possible, therefore, that the state of fineness reached was too extreme for a naturally sticky soil, deficient in organic matter. It might be that the sort of tilth required in the conditions indicated was one of superficial fineness, super-imposed upon a somewhat lumpy and firmer stratum of soil.

Mr. H. DREWITT (Chichester) followed with a description of farming on brick-earth soil in Sussex. Perhaps the most noteworthy feature is the number of ploughings—at least three—still considered necessary in the preparation of a seed bed for roots. Formerly, the number of workings was even greater, but a saving in this respect has been brought about by the use of disc implements and spring tooth harrows.

Ploughing, pressing and broadcasting are still the recognized routine for wheat.

Mr. J. JOYCE (Taunton) dealt with practice in Somerset. The basic implement of cultivation is a one-way plough, fitted with a digger breast and skim coulter. The last-named attachment is invaluable for burying vegetation of all kinds, whether weeds or catch-crops. Mr. Joyce emphasized the importance of timely work and of taking special pains to secure a satisfactory seed bed, more particularly on land in poor heart. In the case of spring cereals, the tilth should be such that one can easily drag one's toe along in the soil nearly up to the instep.

Well-farmed land, where roots have been folded, should be ploughed 7 or 8 in. deep. Land previously impoverished will give a better return if ploughed with a lighter furrow. Mangolds and sugar beet should be grown, preferably, in fields abutting on a good highway. Mr. Joyce generally took the former after a catch-crop of trifolium and vetches, folded off in April. As the fold is moved on, farmyard manure is applied and turned in with the one-way plough.

Generally, Mr. Joyce advocated deep ploughing, followed by stirring, which gradually diminishes in depth, to finally shallow harrowing and rolling.

Mr. J. STEEL (Rochford) dealt with cultivation in South-East Essex, in a climate with an average rainfall of about 20 in. Here potatoes are extensively grown. About 15 loads of dung are ploughed down in autumn, followed by steam ploughing and subsoiling before spring.

Later operations are disc harrowing, cultivating, harrowing, and opening by a combined double-row ridger and manure drill. Eight women plant the potatoes, which are covered by a single baulker doing 4 acres per day. Rye, sown after early potatoes, is 1 ft. high in February, when it is fed off by ewes and lambs.

Plumage Archer barley, drilled in October or November, yields from six to eight quarters per acre, and is, in every way, superior to that sown in spring. Mangolds for milk production were given up in favour of water bowls and a somewhat bigger ration of cake and meal.

As a result of changing to chilled digging ploughs, with reversible shares, Mr. Steel reduced the smith's bill from 5s. per acre to a few pence. Of particular interest was his account of how man, horse and mechanical power can be combined economically in farm work.

Mr. SPILLMAN recounted the methods adopted on the large farms of the Yorkshire wolds, where a farmer may have from 600 to 1,000 acres under the plough. In general, a four-course rotation is followed—namely, roots, barley, seeds, corn—the last-named consisting partly of wheat and partly of oats.

Sheep, at the rate of one per acre, have been considered indispensable on this class of farm, but the recent fall in prices, coupled with the high cost of growing roots, is operating seriously against financial success. Some farmers are beginning to look to temporary leys and kale as a way out of their difficulties.

As a means of saving labour, the use of the double-furrow plough is rapidly gaining in favour. It is interesting to note that in this high-lying part of Yorkshire two of the most successful cereals are Little Joss wheat and Goldfinder oats. The latter, however, must be got in early.

A useful discussion followed, after which Sir JOHN RUSSELL briefly summed up the chief points of the papers.

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International Institute of Agriculture

THE International Institute of Agriculture at Rome, which is referred to from time to time in these pages, is an organization of an official character established by an international treaty or convention in 1905 to which some 70 different countries have now adhered. The expenses of the Institute are shared by these countries on a scale divided into five classes, the contribution of each country being determined by the class in which it is enrolled. The total expenditure of the Institute for 1927 and 1928 has been fixed at 5,260,000 lire, or about £50,000, but there is in addition certain expenditure covered by voluntary contributions which are made from time to time for special purposes either by Governments or by private organizations.

The work of the Institute has in the past been mainly directed to the collection and publication of information relating to agriculture, the most important being perhaps the issue of international statistics of the production of crops, though in addition the Institute has maintained since its foundation the regular publication of technical and economic intelligence. Recently an endeavour has been made to expand the activities of the Institute in various directions, and to bring it more directly in touch with scientific experts on the

one hand, and with agricultural associations on the other. With this end in view, it is in process of establishing a Scientific Council of eminent men in different countries, who can be consulted from time to time either by correspondence or at meetings to be held in Rome. In the same way a scheme has been devised whereby the principal agricultural associations of the different countries will be invited to nominate representatives who will be available for consultation, and thus advise and keep the Institute informed of the views and opinions of practical agriculturists.

The management of the Institute is entrusted by the terms of the treaty to a Permanent Committee, on which each adhering Government has a right to be represented by one member. For a number of years Great Britain was represented by the late Sir Thomas Elliott, who resided in Rome for that purpose. Since the death of Sir Thomas Elliott it has been decided for the present to discontinue the practice of having a resident representative, and Mr. R. J. Thompson, C.B., O.B.E., the Assistant Secretary in charge of the Economics Division of the Ministry, has been appointed as the representative of Great Britain and Northern Ireland on the Permanent Committee of the Institute. Mr. Thompson has also been appointed by the respective Governments as the representative of Australia, Canada, India and New Zealand, on the Permanent Committee.

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Agricultural Statistics, 1926: Part I.

THE Ministry's annual report on the acreage of crops and grass, the production of the principal crops, the number of live stock, the number of agricultural holdings, and the number of agricultural workers employed thereon in England and Wales in 1926 has now been issued. The report discusses the method employed by the Ministry in estimating production of crops, the chief changes in the statistics generally as compared with 1925, the increase in the acreage of sugar beet and the quantities of this crop dealt with at the various factories, and the number of poultry on agricultural holdings.

The tables attached to the report contain detailed figures of the acreage under each crop, of the numbers of each class of live stock, and of the yields per acre of the chief crops in each county of England and Wales, together with summaries

for Great Britain and Ireland over the last 10 years. This year, information which for a number of years past has been published separately as Parts I and II of the *Agricultural Statistics* has been combined in a single volume, with the object of bringing together, for the greater convenience of readers, matter which is very closely related.

This combined report now forms Part I of the *Agricultural Statistics of England and Wales,* 1926, and may be obtained through any bookseller, or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1s. 3d. net or 1s. 4d. post free.

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Scholarships for Agricultural Workers

THE experimental period for which the scheme of scholarships for the sons and daughters of agricultural workmen and others was approved, ended on March 31, 1927. There were three grades of scholarship: Class I, for courses of three or four years at universities or veterinary colleges for degrees in agriculture, horticulture, or veterinary science: Class II, for two-year diploma courses at agricultural colleges: Class III, for short courses at farm institutes and similar institutions. During the experimental period, 612 scholarships were awarded, 49 in Class I, 55 in Class II, and 508 in Class III.

A report on the working of the experiment has now been issued by the Ministry (Report of the Central Scholarships Committee published by H.M. Stationery Office, price 1s. 3d. net). Generally, the progress made by the scholars has been noteworthy and some have done exceptionally well. Among the small number of Class I scholars who have completed their courses, one obtained the degree of M.Sc.; two that of B.A. with honours; one, B.Sc. with honours, and two, B.A. with post-graduate diplomas. A few have won university prizes, one veterinary student gaining the gold medal for his class two years in succession. In Class II, the educational progress made by the majority of the scholars was distinctly good; most of them obtained National Diplomas in addition to College Diplomas. The positions taken at farm institutes by Class III scholars bearing in mind their earlier educational handicaps, exceeded all expectations. At the date of the Committee's Report, 355 Class III students had completed their courses, of whom 294 gained the certificates or diplomas issued by the institutes, 102 obtaining first-class certificates or certi-

ficates with distinction, and no fewer than 28 of the students securing first places in the courses. There were five gold medallists, one silver medallist, and a number of other prize winners.

The ultimate aim of the scheme is to benefit the agricultural industry as a whole. The Committee state: "In land work, success depends largely on the efficiency and skill of the persons engaged in production; any measures which tend to maintain and increase the efficiency and skill of selected workers, and also to enable them in later life, as bailiffs, foremen, dairy managers and otherwise, to direct the details of the industry, must have an important effect on the development of agriculture." At the same time, there must be prizes in the industry to be won if applicants for scholarships are to be forthcoming.

So far as Class I is concerned, opportunities for testing the effects of training have largely been absent, as only 9 out of 49 scholars have, as yet, completed their courses of study. Much interesting information is, however, given in the Committee's Report as to the subsequent progress of the Class II and Class III scholars. With exceedingly few exceptions, these students have returned to farm work, and some of them, particularly the older students, have already substantially improved their positions. Within the limits of this note, it is impossible to enumerate all the later life successes of scholars, but a few examples are given. One Class II student, formerly a milk recorder, is now manager of a group of farms totalling over 1,000 acres; another, formerly a farm worker, is now manager of a well-known experimental farm; a third, formerly a dairymaid, is now an assistant dairy instructress; a fourth, formerly a farm worker, is tillage foreman on an estate of 1,000 acres; a fifth, formerly a working gardener, is an horticultural instructor, and a sixth, another working gardener, is head gardener and gardening instructor at a farm institute. Two of the Class III scholars are now farm bailiffs, five are foremen, four are head stockmen, fifteen are working at farm institutes or research stations, one is an assistant horticultural instructor, and another is an assistant poultry instructress. Among other posts secured by ex-Class III students are managers (and manageresses) of dairies, cheese factories and poultry farms.

In view of the satisfactory results of the experimental scheme, the Government have decided to continue the scholarships in a slightly modified form, as recommended by the Committee. Particulars of the continuing scheme were given on p. 79 of last month's (April) issue of this JOURNAL.

THE NEED FOR IMPROVED METHODS OF SELLING AGRICULTURAL PRODUCE

R. J. THOMPSON, C.B., O.B.E.,
Assistant Secretary, Ministry of Agriculture and Fisheries.

BRITISH farm produce is meeting with a rapidly growing competition from all parts of the world, and this competition is remarkable for the extent to which it is made up of produce of the highest class. At one time, most imported produce (apart from certain luxury articles, such as early fruits) was, on the average, inferior, and British produce could hold its own by reason of freshness or nearness to market. In recent years, the standard of imported produce has been so raised that much of it competes very closely with the best English produce. In all cases, imported produce is in a superior position as a commercial product on account of regularity of supply, evenness of quality and other considerations which admit of goods being dealt with on a large scale. The result is that, with many commodities, wholesale merchants find it more convenient and advantageous to handle imported goods, and English farm produce is being gradually pushed off the wholesale market.

There are naturally many reasons which have led to this change in position, such, for example, as the development of refrigeration, but, in essence, standardization appears to be the real secret of the commercial success of imported produce on our home markets. The classification of the produce into grades according to quality, and the observance of absolute uniformity in the grades, enables the purchaser to get exactly what he wants; wholesale trading is facilitated, distribution is made more elastic and less costly, sales can be made on description only, credit can be obtained from banks, and business, instead of being conducted on retail lines where each consignment differs from the next, is put on a commercial footing. Standardization is, of course, much more easily applied to some articles than to others, but it is questionable if there is any article on the wholesale imported food market which is not standardized to some extent. There is, therefore, an urgent need for the application of standardization to English produce, so that it may be put more on a footing with imported goods. Apart from purely commercial advantages, the classification of produce into quality grades results in higher relative prices to the producer for the top grades, and thus encourages and stimulates the production of the better

qualities. Indeed, one remedy for agricultural depression is to be found in raising the average quality of the output, so that a larger proportion is really of first quality and realizes first quality prices.

No doubt standardization begins on the farm, but, from a marketing standpoint, grading may be regarded as the first stage in standardization, and the first step towards effective grading is the definition of standard grades for the different commodities. Another phase of standardization lies in the selection and fixation of the most advantageous form of package—its dimensions and capacity, its construction and cost—so that the uniformity in quality secured by grades is supported and aided by uniformity in the package, the two taken forming a unit understood and recognized in the trade. To secure uniformity by these means presupposes some measure of agreement among all concerned, both producers and distributors, so that they all work along the same lines.

It is here that our competitors have such an enormous advantage. The fact that the goods exported to this country have, of necessity, to be concentrated in a limited number of channels and dealt with in large consignments of a wholesale character, naturally, and almost inevitably, leads to a certain uniformity. The trade falls into the hands of large co-operative societies or other trading organizations, which adopt measures of this sort, in the first instance, for their own convenience and for the furtherance of business. A further stage, which is becoming increasingly common, is for Governments to control by regulation the quality of the goods exported, and to insist on the adoption of standard grades. These methods cannot easily be applied in this country. Even in the " exporting areas " of England and Wales, there is no " bottle neck," such as a port, through which goods have to pass and at which their quality can be controlled, while the voluntary control of production and trade by large co-operative organizations, which is so successful on the Continent and in the United States, does not offer very favourable prospects owing to the limited extent to which co-operative principles have been applied by producers to the sale of agricultural produce in this country.

It is necessary, therefore, to consider how the principles involved and the objects aimed at can be secured by means suited to our special conditions. An essential preliminary is the close investigation of the circumstances of the trade in each commodity. This is being carried out by the Ministry, and the results are being published in the Reports in the Economic

Series. As regards standard grades, the Ministry is putting forward proposals and suggestions setting out exactly the classes into which each commodity might be divided on a weight and quality basis. These are only put forward, in the first instance, in a tentative manner, and it is for the trades concerned to consider how far these grades are suitable to their particular circumstances, or what modification of them is desirable. In order, however, that the proposals may be judged by actual examples, demonstrations of these grades as applied to eggs, poultry, fruit and pigs will be on view at a number of agricultural shows during the coming summer.

The best form of package is, perhaps, more difficult to determine than the grades of quality, but the advantages and disadvantages of the different types are being discussed in the same way. In the Fruit Report, a complete set of standard packages is put forward for consideration. In the case of poultry and eggs, a Committee representative of all sections of the industry is, at the invitation of the Ministry, considering the types of packages which can best be recommended. When this Committee has reported, specimens of the packages recommended will be shown at the Demonstrations at Agricultural Shows referred to above.

The determination of grades and the selection of packages is one stage on the road, but it does not solve the question how they are to be made effective and brought into common use. Looking at the matter from a broad point of view, there seem to be certain lines of action which deserve consideration. In the first place, it must be recognized that only those producers whose output is large can themselves perform the services of grading and packing economically and efficiently. As a general rule, in areas of surplus production, the output of many producers needs to be brought together and dealt with on a sufficiently large scale to spread the cost of handling and to secure the highest efficiency. This concentration and bulk handling of produce can be done by producers' co-operative societies, or, alternatively, by traders who buy up the produce and themselves prepare it for market, or, again, by organizations which act as agents for producers and may be financed by them.

The problem is to bring the various interests together and secure agreement as to common action; no single system will meet all circumstances, but it may be useful to consider some of the principal alternatives. It is possible to have a purely voluntary system, or a compulsory system, or a combination

of both, that is to say, a voluntary system, under which those who elect to come within its operation accept certain legal obligations.

A voluntary system, which would be suitable for certain commodities, can be suggested on the following lines, *viz.*, the formation of a union or association of persons engaged in the sale of some particular agricultural product in an " exporting area " with a view to their agreeing mutually and jointly to adopt a definite system of grading and packing. By the phrase " exporting area " is meant an area where the bulk of the output is regularly sent in wholesale quantities elsewhere. In so far as produce is already collected and graded by distributors rather than by producers, it would be a case of uniting these distributors for joint action on the lines suggested. Alternatively, if the existing agencies were few or inefficient, the most effective method would be for producers to set up such collecting or packing centres as were needed to deal with the output. In any case, the object would be to secure that sales and deliveries of a wholesale character (*i.e.*, above a prescribed quantity) should be made only on the basis of the agreed grades and in the prescribed packages.

An additional strength would be given to such an association by the use of a trade mark or brand to be applied only to produce of a defined quality or grade. The members of the association would agree on a system of voluntary control whereby a brand—signifying excellence of quality—was used, and exclusively used, for produce which fulfilled certain requirements. To make such a trade mark or brand of real value, a good deal of advertising would be necessary, and the brand would need to be used not only in the wholesale but in the retail trade. The difficulty, of course, is to ensure that the control by the association is sufficiently strong and effective to prevent the brand from being improperly used. This involves not only inspection of consignments, but power to enable the association to take action against defaulting members and to impose a substantial penalty.

An experiment somewhat on these lines was made, as regards fruit, by the Federation of British Growers in 1920-21, but was not successful, mainly owing to the difficulties mentioned. In any case, it was national and not local in its conception and administration. On the other hand, the scheme of the British Glasshouse Produce Marketing Association, which is mainly applied to the output of the Lea Valley and Worthing areas, and includes standard grades and packages, a registered

trade mark, an advertising campaign, and other features, has been in operation since 1922. The marketing scheme, now being attempted by producers of Cheshire cheese, is somewhat similar. No doubt there are many practical difficulties, but it is conceivable that a group of producers and distributors united together in an "exporting area," grading and packing their products on an agreed system, and reinforced by a trade mark or brand, could build up an extensive trade, which would have the effect of stimulating the production and sale of first-class produce. If it were possible to organize associations of this type in exporting areas, it would have the effect of putting such exporting areas in a similar position to individual countries exporting to the British market. Producers in such areas could set up any packing stations or collecting centres that they considered necessary, either as co-operative societies or as limited companies financed by producers, but it would be desirable that existing traders, engaged in a similar business in the area, should form an integral part of the scheme, so that all dispatching centres should be conducted on uniform lines as regards grades, packages, and the use of a common trade mark or brand. Whether an association of producers and distributors is a practical proposition can only be settled by those concerned, but it should be borne in mind that combination for a common object is one of the methods by which our competitors have obtained their present hold on the British market.

If a number of such local associations could be formed, then the next stage would obviously be the federation of these Associations in a national organization, all the units of which used the same grades and the same trade mark.

The difficulty in any purely voluntary scheme, such as the above, lies in securing the use of the quality grades, and the trade mark, in a uniform manner by all the members of the association, and it is in this respect that some Government support seems likely to be required. It is conceivable that this might be given in two ways without in any way destroying the voluntary nature of the scheme, *viz.*, by the establishment of a Government brand, and by the legalization of standard grades.

The use of a Government brand or trade mark might be authorized in respect of commodities reaching a certain standard of quality and complying with certain conditions. In such a case, it would probably be necessary to license or register traders entitled to use the trade mark, to arrange

for sampling and inspection of consignments, and for penalties for misuse. The use of the trade mark, however, would remain entirely voluntary, and only those who wished to take advantage of it would be subject to the conditions necessary to ensure that the mark was really a guarantee of quality. The value of a Government mark might prove quite considerable, and, whilst the mark would require advertising, it would also provide a subject which could definitely be advertised.

Two examples of Government marks may be mentioned. One is the " Kangaroo " Brand of Australian butter ; all butter exported from Australia is graded, and the butter classed as " choicest " is branded with a kangaroo to denote that such butter is Australia's best quality. Another is the official Danish mark known as the " Lur Brand," which is applied to butter and bacon. This started in a voluntary manner by the registration of a trade mark and the formation of an association of co-operative and private creameries which agreed to adopt the mark. Subsequently, the Government was invited to make the mark obligatory on all butter exported from Denmark, and a mark was also adopted for bacon. In the case of butter, a certain quality standard is required, and the brand can be used only by approved and registered creameries, but, in the case of bacon and pig products, the mark is intended more as a guarantee of freedom from disease. In both cases, the use of the Government mark has proved a very valuable asset to the Danish trade.

The second method which would be of considerable assistance would be to legalize approved and agreed grades and packages as definite standards of quality and quantity. This would enable certain goods to be dealt in on description in the same way as a simple weight or measure, *i.e.*, just as a sale of a cwt. implies and requires the delivery of a weight of 112 lb., so the sale of a specified grade or package would require the delivery of an article of a prescribed quality or quantity. This again would be legislation of a permissive or voluntary character, as it would only apply to sales made in this way. It could, however, be connected up with both the ideas mentioned above. The legalization of a standard grade for first quality might provide the basis for a standard to which the suggested Government mark could be applied, while voluntary associations of the kind already indicated would certainly be much assisted in the conduct of their business by the existence of approved and recognized standards.

The above are examples of voluntary or semi-voluntary methods which seem worth consideration. There remains the question whether, in the case of certain commodities, the use of prescribed grades and, if need be, prescribed packages, should not be made compulsory by law, at any rate in wholesale transactions.

The compulsory use of prescribed grades is the method most commonly adopted by our competitors, but it is usually only applied to produce for export. Its application is thus relatively easy, as the produce, having to pass through a port, can be inspected and tested to see that it complies with the conditions prescribed by law. The adoption of any similar system in this country is made correspondingly difficult by the absence of any central point at which produce can conveniently be inspected. Nevertheless, the fact that so much of the produce put upon our markets is compulsorily graded, and is inspected and supervised before export to this country, is a very serious matter for agricultural producers in this country, and, unless some other system can be devised and brought into operation at an early date, it may be doubted whether the mere difficulty of compulsory grading will constitute a sufficient justification for neglecting to put home agricultural produce in a position to compete with imported goods.

In any attempt at compulsory grading, different commodities would present different problems which would call for different treatment. Broadly, however, the need would be, in the main, to regulate the sale of wholesale quantities, and this could probably be most conveniently done by legislation requiring packers and wholesale distributors to comply with certain conditions. Obviously, the consent and co-operation of a majority of the persons concerned would be required, but it is a remarkable and noteworthy fact that there is a growing tendency in practically all exporting countries in the direction of legislation regulating trade in one form or another, and that this legislation is proposed and passed at the request of the persons or organizations concerned, and with their entire approval and support.

In any case, an immediate and rapid improvement in methods of marketing agricultural produce in England and Wales is needed. The problem is to induce producers and traders to recognize that it is in their own interest, as well as in the interest of agriculture and of the country at large, to adopt methods which will encourage and reward the production of

produce of first quality, and thus open the way to a united effort to restore home produce to the position it should hold by right on the home market.

Closely connected with the problem of improved methods of marketing is the question of advertising. Except in the case of one or two commodities, advertisement has not been much used as a means of increasing the sale of home produce, and where it has been adopted the difficulties met with have not been small. Taking advertisements in the broad sense as including all kinds of publicity, whether by means of advertisements in newspapers or by posters, publications, etc., or by means of exhibitions such as the British Industries Fair or the Imperial Fruit Show, there are two main objects which may be attained—first, the maintenance of the general sentiment in favour of home produce and; second, the creation of a demand for particular products. An example of advertising of the first kind is afforded by the general scheme of the Empire Marketing Board, which is aimed at encouraging purchasers to demand and to obtain produce from the Empire, both home and overseas. In this connexion, the existence of a patriotic desire to support home industries is a valuable asset to the home grower, and one of which he should take full advantage.

The creation of an additional demand for particular products presents more difficulty. It is first of all necessary that a supply should be forthcoming to meet the demand which the advertisement is hoped to create. If the supply is not there to meet the demand, not only is the advertisement wasted, but it may well be that the demand is diverted into other channels and cannot subsequently be recovered. Further, if the advertisement is to succeed, there must be means of identifying the produce both as being of British origin and of first-class quality. It is here that prescribed grades or standards of quality, supported by a national trade mark or brand, become of importance. If only these two ideas could be put into operation, advertising of particular products would become practicable and valuable. All that would then be necessary would be to adjust the scope of the advertisement to the available supply in such a way as to create a corresponding demand, but if advertisement is to be used effectively to enlarge the market, and hence to stimulate production, it needs to be based on a guaranteed standard of quality, supported by a national trade mark or brand, and accompanied by an efficient marketing system.

RURAL CONTINUATION CLASSES

Circular Letter to Local Education Authorities.—The following circular letter, upon the subject of Rural Continuation Classes, has been forwarded, jointly, from the Ministry of Agriculture and Fisheries and the Board of Education to Local Education Authorities :—

We are directed to refer to the letter of November 25, 1925 (T.E. 3618/C.L.), issued by the Ministry of Agriculture and Fisheries to County Agricultural Education Authorities, and circulated by the Board of Education to the Education Committees which do not deal with agricultural education. That letter notified the revised arrangements made by the two departments in regard to part-time instruction for students between the ages of 14 and 16, and, in pursuance of the last paragraph, of the letter we are now able to lay before Authorities suggestions for the conduct of Continuation Classes for students of the ages in question. These suggestions, which are incorporated in the enclosed Memorandum, have been formulated by the Inter-Departmental Committee of the two Departments. It is believed that they are applicable to all rural continuation courses which include both a general and a technical agricultural element, even though, according to the preponderance of one or other of these elements, some of these courses, under the revised Regulations shown in the Appendix to this circular, may be aidable by the Board and others may be aidable by the Ministry.

The Committee have pointed out that over 60,000 boys and girls between the ages of 15 and 16 were employed as wage-earners in agriculture at the time of the 1921 Census, and that, if regard be also had to those who are not in actual employment in a wage-earning capacity, or who are engaged in rural pursuits not definitely agricultural, it will be apparent that there is much scope for the provision of classes designed to stimulate or maintain the interest of these young persons in an agricultural career. It is suggested that County Authorities should provide organized courses on the lines set forth in the Memorandum. The instruction should include subjects of general education for both sexes ; with the addition, for boys, of such subjects as rural science, carpentry, and manual processes, and for girls, of dairying, poultry-keeping, horticulture and domestic subjects. In particular circumstances, instruction in such a subject as

dairying, poultry-keeping or horticulture will be suitable also for boys. In courses of domestic science for girls, it is important to include instruction dealing with the use and conservation of home-grown produce and with labour-saving methods.

A few authorities have included in their programmes, submitted to the Board in pursuance of Circular 1358, proposals for some expansion of the continuation school system, and it is known that in some areas the question of making provision, for students between 14 and 16, under the Regulations of the Ministry has been under consideration. In these cases, it is hoped that the Inter-Departmental Committee's suggestions will be useful in the working out of schemes of instruction.

The position in regard to the aiding of expenditure on instruction of the nature referred to in the Memorandum is fully set forth in the letter of November 25, 1925. The Ministry, however, desires again to emphasize the suggestion made in the last sentence of that letter, *viz.*, that in Counties where agricultural education is dealt with by the Agricultural Committee of the County, that Committee should consult with the Education Committee if it proposes to provide part-time instruction for students under the age of 16.

Appendix.— EXTRACT FROM THE REGULATIONS OF THE MINISTRY OF AGRICULTURE AND FISHERIES FOR GRANTS IN AID OF AGRICULTURAL EDUCATION PROVIDED BY LOCAL EDUCATION AUTHORITIES IN ENGLAND AND WALES.

11.—(i) Except as indicated in (ii) below the Ministry will recognize and aid the following types of instruction :—

(*a*) All instruction given as part of his staff work by a teacher recognized by the Ministry as a member of a County Agricultural Education Staff or of the staff of an Agricultural College.*

(*b*) All courses in which instruction given is wholly or mainly in technical agricultural subjects.†‡ Instruction

* A member of a County Agricultural Education Staff whose time is spent partly on work relating to School Gardens and/or Teachers' Classes will not be recognized by the Ministry in respect of such work, and an apportionment of his salary in this connexion will be required.

† In counties where agricultural education has been transferred to the Agricultural Committee, such courses, if intended primarily for students under 16, should be arranged in consultation with the Education Committee.

‡ The arrangement of day and evening part-time courses, including instruction in both agricultural and general subjects, will be encouraged by the Ministry and by the Board of Education. Where a course of

in Gardening or the care of Small Live Stock will not normally be regarded as instruction in a technical agricultural subject, if it is given by a person who is employed as a full-time teacher in schools or classes recognized by the Board of Education.

(ii) The following forms of instruction will not be recognized or aided by the Ministry :—

(*a*) Education provided in or as part of the curriculum of Elementary or Secondary Schools.

(*b*) Instruction recognized by the Board of Education under their regulations§ for Technical Schools, etc. (*See note* (‡) *on previous page.*)

(*c*) Courses for the training of teachers employed, or students intending to obtain employment as teachers, in schools or classes recognized by the Board of Education.

Memorandum.—The following is the Memorandum referred to in paragraph 1 of the above letter :—

Summary of the Recommendations of the Inter-Departmental Committee.—The witnesses examined by the Committee were unanimous in regretting the lack of educational provision for young persons in rural districts who have just left the elementary school, and were convinced of the need for classes which will bridge the period between leaving the elementary school and the age when the boy or girl becomes old enough to profit by the instruction organized for those of sixteen years of age and over, by the County Agricultural Staff, at a farm institute or elsewhere.

The Committee believe that Young Farmers' Clubs are a great asset in fostering an interest in general and technical education, and that this movement should be extended.

The main difficulty, in connection with the proposed classes, is of an economic nature. Prospective students would be drawn from homes which could ill afford that members of the family should lose wages in consequence of attendance at day classes, and it appears doubtful whether, in the present condition of agriculture, farmers would be willing to pay an employee in

this nature is primarily agricultural it will be aided by the Ministry. Where the elements of general instruction predominate, it will be aided by the Board. If a teacher recognized by one Department is employed, during the time for which he is paid a salary, on a course recognized by the other Department, no apportionment of his salary will be required. Additional expenses, however, such as overtime charges, or travelling and subsistence allowances, will be aided by the Department recognizing the course.

§ Now the regulations for Further Education (Grant Regulations, (No. 6).

respect of the time spent in class work. Girls would be more likely to take advantage of the opportunities offered, as the majority of them seem to be retained for work at home.

It is considered that the aim in such instruction should be to combine some practical training with the continuance, to an appreciable extent, of the general education of the student. It is suggested that Local Authorities in considering the matter should give special attention to

(*a*) The general circumstances of the students, and the relation of training to local agricultural occupations.

(*b*) The selection of suitable centres, in order to bring instruction within the reach of the small number of rather sparsely distributed students.

(*c*) The selection of suitable teachers.

With regard to (*a*), a class arranged in a district of small farms would differ from one in a small-holdings area, or in a locality where large farms predominate. In any case, however, it is most desirable that neither the syllabus nor the method of teaching should give pupils the impression that they are merely "going back to school." The club spirit should be fostered, and students invited to express a voice in the arrangement of classes, the selection of subjects and the general conduct of the course. English, arithmetic, rural and domestic science should all be taught in close relationship to the outdoor occupations which students are likely to pursue, such as the care of live stock, dairying, poultry-keeping, bee-keeping and gardening, and the cultivation, marketing and preservation of fruit and vegetables. Every course should include practical work as well as theoretical instruction; neither branch should be taken for long without some demonstration of its connexion with the other.

Four to six hours of instruction a week would be desirable, and, while local conditions must determine the number of hours, the Committee suggest five possible methods of arranging the meetings:—

(1) Two evenings a week for two hours each. (This arrangement would obviate any difficulty about payment for broken time; but there may be difficulties about evening attendance and it makes no provision for systematic instruction in practical work out-of-doors.)

(2) The afternoon and evening of one day. (This method is the more equitable arrangement as between employer and employee. Difficulties of travel are minimized, and practical work is made possible; but arrangements to enable students to have a meal may be necessary.)

(3) Two afternoons per week. (If employers were willing to release their young workers twice a week, this would appear to be the ideal allocation of time.)

(4) A whole-time course of two to six weeks' duration. An effort should be made to organize an experimental course of this type (non-residential) in suitable counties, at any rate for girls.

(5) Attendance on one day a week for a period of, say, twelve weeks.

The Committee consider it important that the boys and girls who have attended these continuation classes should have a reasonable chance of obtaining further education, and they suggest that provision should be made for scholarships which would enable promising students who have attended at least one continuation course to proceed to a farm institute.

(*b*) The difficulty of arranging suitable centres for the instruction of children, who will probably be widely scattered over the countryside, might be overcome by arranging for the classes to be held at a limited number of centres, easily accessible by rail or omnibus, or to which students might be brought by the provision of motor transport—a method which has proved economical and successful in at least one English county. Centres should be selected where facilities would be available for taking the boys on to farms and, if possible, into rural workshops; and for taking both boys and girls into dairies, poultry yards, gardens, etc.

(*c*) Local circumstances must determine the method of selecting the teachers. The instruction in agricultural subjects may be given by members of the county agricultural staff. In appointing teachers in these subjects, consideration should be given to the advantages of selecting those who have had training and experience in the art of teaching pupils under sixteen years of age.

If local authorities are unwilling to make special provision for this kind of instruction until they are in a better position to judge of the demand for it, the Committee suggest that it would be helpful if in every county at least one class were organized at a suitable centre, in order to test experimentally the demand.

Curriculum.—It is assumed that the intention of the course will be, on the one hand, to provide some definitely vocational training, and, on the other, to enlarge the information of the students and their stock of ideas, to help them to express themselves in speech and writing with reasonable freedom and accuracy, to give them further instruction and practice in calculations, to develop their reasoning powers, and to encourage, judiciously, the habit of reading both as a means of acquiring information and as a source of rational enjoyment.

Teachers should be encouraged to think of the definite ends which may be reached under the actual conditions, and to consider for themselves how they can best make the discipline and experience, which the course will supply, effective for its purpose. The course, including the practical work, should be regarded as a whole, and if two or more teachers take part in it they should consult before finally settling the syllabuses for their respective shares of it. The teacher should arrange his instruction by a more or less definite plan, which might need modification in the light of experience. It should be understood that visiting inspectors would encourage such departures from the scheme when sound reasons can be adduced.

It is not proposed that the whole of the subjects dealt with in the following outline of a course should be taught in any one school. At the majority of centres a selection from each of the four groups of subjects will be desirable. The course might extend over two or more winters, and a cyclic arrangement in the treatment of the subjects should be adopted. This would overcome the difficulty of arranging first and second year courses at any one centre.

The suggestions as to English, mathmatics and science are applicable to young persons of either sex.

ENGLISH SUBJECTS. Group 1.—In the treatment of English subjects, the course might include literature and composition, history, geography, and rural economy. Students might be encouraged to consult books of reference and to read works in English literature which have a bearing on rural life.*

For the purpose of providing training in the power of expression, oral discussion and the writing of essays on the books studied and on rural matters are of primary importance. The writing of business letters and exercises in the keeping of simple records, suitable for rural conditions, should not be neglected. The students should be encouraged to write occasional essays during the summer period.

The history course might deal with topics drawn from social as well as industrial and political history or such aspects of the subject as the local systems of land tenure, the progress of agriculture and developments of rural conditions and co-operative enterprise.

* In certain counties in Wales, what is here said with reference to English literature will apply to Welsh and Welsh literature.

In geography it will not be difficult to discover aspects of particular interest in rural districts and to treat them with considerable fullness. It will be possible to give attention to climatic conditions (temperature, rainfall, winds, etc.) and their influence on natural products; the distribution of arable and pasture land, and of different types of farming, and the causes which influence it; agricultural imports and the conditions under which they are produced.

In connexion with rural economy, it will be possible to deal in an elementary way with such matters as Acts of Parliament, Local Government, Government Orders and Forms, local bye-laws, methods of co-operative trading and co-operative enterprise applicable to rural districts.

MATHEMATICS. Group 2.—In dealing with calculations, the application of arithmetical principles to rural problems should be kept in view, and the instruction should be of a decidedly practical character. Students ought to have practice not only in dealing with figures, but in making measurements, and otherwise securing the data upon which their calculations are based. The course might include farm book-keeping of an elementary character and some simple surveying and levelling.

In this connexion, it may be noted that farmers often employ their daughters as secretaries, so that instruction in arithmetic, in the form of keeping farm accounts, is needed for girls as well as for boys.

SCIENCE. Group 3.—In the teaching of science, adequate attention should be given to experimental work. The course might embrace an elementary study of air, water and soil, and of plant and animal life, with such further work as will give the student some understanding of the nature, composition, and action of manures and foods. Some study of heat and of mechanical powers might also be included.

CRAFTSMANSHIP. Group 4.—For the younger students, training in the use of ordinary hand implements might prove of considerable assistance if they were taught to conserve their strength, and to adopt methods which would secure speed combined with efficiency. Physical exercises directed to this end might be of considerable value.

Instruction in farm processes should aim at informing the student of the why and the wherefore of the process, and demonstrations should be consistently used for this purpose. Where boys are concerned, a selection of processes suitable to

the district should be made from such operations as ploughing, hedging, draining, stacking, thatching, planting and pruning fruit trees, spraying of crops, care of farm animals and dairy work. Students should become acquainted with the working of the main agricultural machines, including some form of prime mover.

Woodwork should embrace instruction in the use and care of tools, the recognition of various timbers, their properties and uses, the preservation of materials, and the making and repairing of various tools and appliances for rural use. Independence, originality and resourcefulness ought to be encouraged.

For girls, instruction might be provided in such subjects as care of live stock, dairying, poultry-keeping, horticulture, bee-keeping, laundry work, housewifery, cookery (with special reference to fruit preservation, bacon curing, and the general utilization of home-produced food). Some of these subjects are, of course, suitable for boys.

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ELECTRICITY IN AGRICULTURE.—I

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The Supply of Energy.—There are two points of view from which the question of electricity in agriculture may be considered: that of the consumer—the farmer; and that of the supplier—corporation or private company. As regards the consumer, there are, at the present time, many farmers in this country whose farms are within convenient and accessible distance of an adequate supply of energy, and who are duly taking advantage of the fact. If not all of them are doing so, it is either because they are not yet fully assured that it would, in their particular circumstances, be to their benefit, or because they have not yet given the question much consideration. It is here that the dissemination of well-considered information, educative rather than propagandist, would serve a very useful purpose, and it is hoped in the second article of this series to offer some contribution in this direction. But there is a less fortunate class of farmers who, however they might wish to employ electricity, cannot do so, for the simple reason that they have no supply available. For these it may be useful to

know something of the conditions which govern the distribution of electricity; such a knowledge will help them to meet, as it were, half-way any steps that may be taken to offer them a service. They should, in other words, be able to appreciate the point of view of the supplier.

It may be taken for granted that any supply company or corporation is only too willing to undertake the supply of power in any area if it is going to pay to do so—that is to say, if the revenue produced by the sale of energy covers expenses and leaves a sufficient margin of profit. It is obviously theoretically possible to secure this by charging a sufficiently high rate per unit of energy delivered, but electrical energy, like any other commodity, must be sold at a price at which the consumer can use it profitably.

Extension of Supply to New Districts.—In the case we are considering, of the extension of electrical supply to new districts, it is scarcely worth while suggesting the idea of a subsidy. Facilities for credit exist in various forms and should be sufficient to meet the case. And a possibility, worth a passing notice, is that of a moderately large town, in the centre of a large farming district, with its prosperity, to a considerable degree, dependent on the prosperity of the farmers, who make it their centre. It might be good policy on the part of a corporation electricity department to extend its supply area to these farms and to sell energy at no immediate profit, trusting thereby to promote eventually a general rise in the prosperity of the district and consequently of their own undertaking. But in the development of any undertaking there are certain economic facts to be met and faced, and it will be well to consider the special features which these present in connexion with the distribution of electricity to farmers.

There are several considerations which confront the engineer who is contemplating the extension of his supply lines into any given rural area. What is probably most important to him—and what will certainly weigh most heavily with the committee, or board, for which he is acting—is the fact that the supply system must work at a profit, and any part or extension of that system must also work at a profit. Now a profit is made, on the year's working, only if the revenue from the sale of energy is greater in amount than A + B. A represents the annual charges due to capital sunk in generating plant, transmission lines and the various distributing lines and equipment; these charges may generally be taken as propor-

tional to the capital cost of all the constructional work. B represents the running costs—*i.e.*, cost of fuel, water, labour—and may be taken, nearly enough for the purpose of illustration, as being proportional to the number of the units of energy actually sold, though this is not strictly true. For a given supply system, A is fixed irrespective of the number of units generated and supplied; and since this charge, A, must be covered by the revenue from energy sold, the first charge on each unit sold is $\frac{A}{n}$, where n is the number of units sold in the year. In addition there is the second charge on each unit of $\frac{B}{n}$, to cover the actual running costs; but as B, as has been observed, is proportional to n, this charge may be regarded as remaining fairly constant per unit, subject only to such variations as may be due to the cost, mainly, of coal and labour.

We see, then, that in a given supply system the cheapest price per unit is obtained when n, the number of units generated annually, is a maximum; this happens when the demand on the power station is such as to keep it running at steady full output day and night. The same applies to each transmission line: to secure most profitable working it should be kept fully loaded all the time. This is a condition which is rarely obtained in practice—and never on general supply systems; it is, nevertheless, the end to which the engineer is striving. A system on which the full load was obtained for, say, one hour per day, and which was idle for 23 hours, would be of no use to him. The standing charges (A) would fall so heavily on the units generated during that hour as to make their price absolutely prohibitive.

Thus, then, the engineer, prospecting the area, is faced with the problem of getting a maximum load for the minimum of erectional and constructional work. Let us suppose that the question of generating plant does not arise, since the existing plant may have a big enough margin for a considerable extra load. Consequently, the constructional work required to serve the new area would be confined solely to the erection of main transmission lines, sub-stations and secondary distribution lines, and the engineer has only one thing to consider; whether the revenue necessary to cover the standing charges on these lines, plus a reasonable share of the existing standing charges on the station, can be obtained without unduly high tariffs. The running cost charge per unit of energy supplied is really

only small, so the difficulty lies mainly in getting the standing charge per unit down to a reasonable figure.

It may be taken that, within limits, the erection charges for a transmission and distribution system for a given load increase with the length of lines necessary. That is to say, to supply energy at the rate of 10 kw., for instance, to a farm one mile away costs half as much as to supply a similar load to a farm two miles away. It is also, approximately, true to say that the *cost of line depends on the rate of delivering energy*; it does not increase in direct proportion, but as the rate of using energy increases, heavier, and therefore more expensive, wire is necessary. Thus, if two farmers are prepared to use, say, 24 units each per day, but one wishes to use his whole supply in two hours, at the rate of 12 units per hour, while the other is prepared to spread his supply over 12 hours, using only two units per hour, it will cost more, distances being equal, to erect a line for the former than for the latter. Thus the latter would deserve, and under some tariffs obtain, his power more cheaply.*

Requirements of an Ideal Supply System.—The requirements of an ideal transmission and distribution system are, therefore, a maximum total consumption of energy at the minimum rate over the minimum distance. Recognizing the impossibility of such attainment, the engineer is left to weigh up the position to see how closely he can approach it, and whether he is justified in taking steps to provide the service.

It must be recognized that the supply company requires some guarantee that their outlay in erecting supply lines will be covered by the revenue, and most tariffs are framed with this idea in mind. This guaranteed revenue is usually obtained by fixing a minimum charge which must be paid irrespective of the amount of energy consumed. There are many different tariff systems in use, but a method which is fairly popular is to make a fixed charge, proportionate to the rateable value of the farms or other premises, and, in addition, a charge per unit of energy consumed. The fixed charge ensures a certain revenue to the company in return for the outlay in making the service

* It may be pointed out that the rate of using energy, or the rate of working, is given in electrical units as kilowatts—kw.—and the number of units of energy used over a given time is the product of the rate of working and the time in hours, giving kilowatt-hours—kw.h. A motor working at the rate of 1 k*w*. for 1 hour or ½ kw. for 2 hours, uses 1 unit, and so on. 1 kw. is approximately equivalent to 1¼ h.p.

connexion, and protects them from people who would use little or no energy after the connexion was made. The unit charge may be on a sliding scale, decreasing after a certain number of units are used; this encourages the consumer to make a liberal use of the energy and so get the advantage of the cheaper rates. Such a tariff rate might be as follows: a fixed charge of 3s. per £1 per annum of annual rateable value of the consumer's premises, and a unit charge of 2d. per unit for the first five units for every £1 of annual rateable value, together with a unit charge of 1½d. per unit for any further units. That is to say, for a farm with an annual rateable value of, say, £200, the fixed charge would be £30; the first 1,000 units used would be charged at the rate of 2d. per unit, and any further units at the rate of 1½d. per unit.

Uncertainty of the Farming Load.—It must be recognized that the farming load is to most engineers in this country a more or less unknown quantity; the circumstances in which power has hitherto been used on farms have not resulted in much detailed information being collected as to the actual requirements of the various operations. Few farmers, therefore, would be in a position to estimate the amount and the nature of the load they could offer to the supply company.

The domestic load, however, is less of an unknown quantity, and the fact that a farmer was prepared to make a considerable use of electrical appliances in the ordinary work of the home would offer the engineer, always faced with the problem of at least paying interest on the cost of erecting the necessary lines, an element of security to set off the uncertainty of the untried farming load proper.

Nor will the engineer leave out of sight the question of village supply, if villages be conveniently situated in the district of which he is considering the electrification. Here again, the load will, in the first instance, be mainly domestic, but the possibility of the supply of power to rural industries will not be neglected. In some parts of the Continent, a considerable amount of power is now absorbed by small manufacturers, rural more in the fact that they are carried on in the villages than that they have any real connexion with rural life. Such development of village and rural industry supply may be slow, but, in the electrification of the countryside, the engineer will not be indifferent to anything that may help to secure a full and evenly distributed load.

COUNTY SCHEMES OF AGRICULTURAL EDUCATION: I.—HERTFORDSHIRE

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Introduction.—The Scheme of Agricultural Education in Hertfordshire falls into four sections :—

The Residential Farm Institute.
The County Demonstration Farm.
Adult Education in the County.
Rural Education.

Each of these sections might be organized independently, but there are certain advantages in combining them. The success of any one section makes for the success of the others. For example, the published balance sheets of the Demonstration Farm have been a potent factor in securing the goodwill of farmers; without that goodwill students for the Institute could not be obtained, and farmers would not so readily take advantage of the advisory facilities.

Undoubtedly the best basis for training a young man in farming is a well-managed successful commercial farm. This type of education is preferred by farmers to that of an institution where the teaching is mainly theoretical, no matter how sound the theory may be. In the past, the majority of young farmers have received their training on their fathers' farms, while a number are sent away from home, for a year or two, to get additional experience with relatives, neighbours, or on more distant farms. Always an impelling motive is to keep the lads at work and to avoid any "kid-glove" period. Herein lies the special value of Farm Institutes, as the training they give meets both the practical ideas of the farmer and the growing need for a knowledge and appreciation of science.

There is still one factor which militates against the free and abundant use of schemes for the training of farmers; this is the fact that success in farming is so generally linked with individual shrewdness in buying and selling. There is also the tendency for "progressive" men to extend this "farm trading" beyond the requirements of the land actually farmed. So long as our marketing is done in the present manner, there will be a temptation to specialize in these "business" transactions rather than in the art of production.

However, one step in the right direction has been taken by the establishment of Farm Institutes, as these provide the essentials for a progressive type of education with a commercial

farm as its basis. Here is found an environment full of rural interests, with endless scope for creative work and a profusion of subjects at hand for study and debate. The commercial success of the Institute Farm shows the farmer that the teachers appreciate the practical issues, and this inspires confidence; the right type of student comes to the Institute; advisory work becomes productive; progressive schemes are supported.

It has also to be borne in mind that upwards of 90 per cent. of the students in agriculture at a Farm Institute will actually become farmers or farm workers, and that the period of training does not exceed one year. The personal qualities, experience, skill and knowledge required to make a successful farmer have therefore to be stressed. It is not possible in this article to discuss this question fully, but it may be said that no amount of manual skill or science will compensate for lack of initiative, industry and judgment, and that good management (direct or indirect) on safe lines is one of the essentials of success.

The Residential Farm Institute.—In laying a foundation on these broad lines, the Farm Institute starts off with certain advantages. The long-course students are in residence for a complete year, and, although their education has varied a great deal, they all find a common interest in the farm. Environment counts for much, and a high standard of institutional management, a successful farm, facilities for study and recreation, all contribute to create the right atmosphere. This is no longer "school"; it is the beginning of the students' life work, and, as they see the teaching of the class room confirmed by the practice on the farm, they get an appreciation of the value of science with practice and, therefore, take kindly to study. It is possible to introduce many lessons from the history of agriculture in this country, and from the development of agriculture in other countries, and to create the outlook which will hasten an extended use of improved methods not only in farming, but also in the marketing and distribution of our home-grown foods.

The Herts Institute ("Oaklands," St. Albans).—Having dealt with some of the fundamental issues, a description can now be given of the methods adopted at the Hertfordshire Institute.[1*] The programme of work varies from term to term, but, taking the year as a whole, it may be divided into three parts—practical work out of doors, class room lectures or

* Numbered references are given at the end of the article.

discussions, and reading and study. The practical work does not make experts in a variety of manual processes, but provides a very sound initial training in such things as the feeding and management of farm stock in the methods to be adopted in producing clean milk and in certain field operations. Included in this part of the programme, are daily questions on farm management, stock, judging, farm excursions and demonstrations, lessons on farriery and on the care of farm machinery, etc. From this work, in conjunction with systematic records from the farm, much useful matter is provided for elaboration in the class room.

No more useful materials can be found for educational purposes than the ordinary crops and stock on the farm. From these, all kinds of measurements, weights and records can be taken, providing for all stages of educational work and leading up to interesting studies of management and economics. With an ever-growing accumulation of data, collected under supervision by past and present students, there is an added interest to lectures and discussions indoors. The spirit of inquiry is fostered and faculties of observation and deduction are developed.

The third part of the programme brings in wider questions relating to agricultural history, national policy, food supplies home and foreign, methods of marketing, etc. The days are past when farms can be conducted as isolated units. Every young man, when he starts farming for himself, will find that the industry as a whole must fight for its rights. As one of the leaders, or as one of the rank and file, he will have to contribute his quota to the solution of many problems. A system of training for the vocation of farming cannot be complete unless it provides a stimulus to study the many difficulties ahead. It is for this reason that at "Oaklands" so much time is devoted to reading and study. A beginning is made with subjects of general farming interest, gradually leading up to more serious study of such matters as have been enumerated above.

The Demonstration Farm.—Reference has already been made to the many ways in which the Institute Farm has contributed to the promotion of agricultural education in this county. This farm has, in fact, been invaluable, both directly and indirectly: directly, for the training of teachers and students, and, indirectly, in creating the spirit of goodwill so necessary for the smooth and efficient running of the whole machinery of agricultural education. These results have fully justified the use of a farm in the county scheme, apart

from other functions which it has fulfilled. Before discussing the latter, it is necessary to have a clear conception of what is meant by a Demonstration Farm. Briefly, such a farm is an ordinary commercial farm, except that provision is made to keep every possible kind of record both with regard to crops and to stock. It may occasionally be necessary to introduce a little more variety in cropping and stocking than would be found in practice, but this is very different from the position on an experimental farm, where commercial practice is usually sacrificed in the interests of research.

Farm recording is, therefore, the keynote of the Demonstration Farm, and the value of such records is illustrated by the following examples from "Oaklands":—

(*a*) Internal *cost* records are a fruitful source of information and add greatly to the value of other records. The opportunity is presented to investigate intermediate stages which escape detection under the general costings scheme. At "Oaklands," results are accumulating in a variety of directions and cost figures have already influenced the cropping and stocking of the farm. In addition, cost accounts have given guidance in the management not only of the farm but also of the commercial poultry and horticulture departments.

(*b*) Although the conditions on a milk-selling farm are not favourable to the production of baby beef, it has been possible to make bull calves, from dairy shorthorn cows sired by a dairy shorthorn bull,[2] into baby beef at a profit. The associated data on the rate of growth of the animals, weights at birth and carcass per cent. are also all of interest and value.

(*c*) From three breeds of grass ewes, each crossed with a Suffolk ram, by recording the number and weight of lambs at birth and by weighing each lamb at intervals till marketed, an exact measure of the relative economic value of these breeds has been obtained.[3]

(*d*) When farmers were giving exaggerated estimates of the yield and feeding value of a crop of marrow-stem kale, the weighing of a sufficient number of plots and the analyses of the kale replaced fictitious figures with facts.

Among other records which are being kept are the following:—

(1) The tillering power of winter-sown Spratt Archer barley.
(2) Observations among sugar beet, mangolds, and marrow-stem kale from the time of seeding to harvest.
(3) Methods of determining yield per acre of root crops.
(4) The value of inoculation of lucerne sown with and without a cover crop.
(5) A comparison of twice and three times milking.
(6) Observations on the rate of growth of pigs.

The difficulty on a Demonstration Farm is not where to find material worth recording, but to keep within the limits of what can be accomplished and analyzed. Any farm run as a commercial proposition teems with material, the study, measurement and recording of which would provide

information immediately useful for teaching purposes and urgently required as a basis for future research.

Adult Education (County Work).—A few of the directions in which county work has developed in Herts. until its effect is now felt in practically every village and rural district are detailed below.

(1) *Lectures, Discussion Societies, etc.*—Upwards of 200 lectures are given each year, sometimes in the form of single lectures, but generally as a series of four to eight. Whatever the subject chosen, whether relating to agriculture, horticulture, dairying or poultry keeping, it is surprising how often the member of the staff who is lecturing is able to give experiences, examples or figures from the commercial departments at the Institutes, to bring home his arguments. Certain it is that this intimate acquaintance with practical and commercial affairs is a source of both versatility and strength. In discussion societies, the ordinary lecture gives place to less formal ways of spreading information. Farmers themselves take part in the discussions or debates, so that all present gain from the experiences of others. It is at such meetings as these that the value of records and statistics is appreciated, as differences of opinion are interminable and often unanswerable except with another opinion unless facts and figures can be quoted.

(2) *Deficiency of Lime on Arable Land.*—Although Herts. rests on chalk it is seldom that this comes to the surface. It crops out in the north, and, throughout the county, old chalk pits give evidence of extensive chalking in the past. To-day deficiency of lime is one of the striking features in many parts of the county [4]: in some parts it is isolated fields or parts of fields that need liming; at other places large areas require liming as a first step towards restoring them to a profitable state of cultivation. On the mixed soils, it is often difficult for the farmer to decide where lime should be applied and where it is not required. In the one case, expenditure on liming is money well spent; in the other, no benefits can accrue. For this reason, during the past year or two, many thousands of acres have been examined by the Agricultural Chemist. The method adopted is to walk over each farm and to test the soils *in situ*. Precise information can then be given, so that each farmer knows exactly how he stands with regard to this important question. Naturally these visits lead to much useful advisory work being done in other directions at the same time.

(3) *Grass Land Improvement.*—By selecting centres for manurial trials, on the typical soil formations in the county, a great deal of useful information has been collected. With such data available, along with the recorded benefits of efficient grazing from the Institute Farm, it is now possible to give reliable advice on the improvement of grass in the county.

At a later date it is hoped to start one or two trials of the new method of increasing the stock-carrying capacity of grass land by the aid of rotational grazing and successive applications of nitrogenous manures.

(4) *Dairying.*—In a county where practically all the milk produced is sold in the liquid state, chief interest attaches to economy in methods of production, to butter-fat tests, and to clean milk production. Bulletin No. 6 issued from the Institute,[5] and showing at a glance how to select the cheapest concentrates and how to combine them to make a balanced ration, is now being regularly used for many herds. Butter-fat testing was started four years ago in connexion with the County Milk Recording Society, and now over 1,000 individual samples are tested each month. The accumulated figures from over 37,000 samples provide useful data on the quality of milk from various breeds, and on the variation in yield from different milkings, and the relationship between quality and quantity.

(5) *Poultry Keeping.*—The setting up, in 1924, of egg-laying trials for poultry farmers, small-holders and others in the county, is likely to prove a real stimulus to this industry in Herts. The profits from poultry are so intimately connected with egg production per bird that this scheme for keeping egg records strikes at the very root of the essentials for financial success from poultry. This again is an example of the value of authentic records.

(6) *Manual Processes.*—The skill of the agricultural labourer is often mentioned, but too seldom encouraged. For over 30 years encouragement has been provided to the farm workers by holding competitions in manual processes. In the case of youths under 20 years, it is a condition of entry in these competitions that definite instruction should be given on their farms prior to the competition. In the past four years, great strides have been made in extending the scope of these competitions until they now embrace the following operations: ploughing, stacking, thatching, drilling, hedging, ditching, land-draining, milking, farriery, hurdle-making, poultry-trussing, and pruning.

(7) *Horticulture.*—Space does not permit describing in detail all the activities in the county, but mention must be made of the great good which is being done to very different classes of the community by spraying trials on fruit trees in large nurseries, by model allotments open to the inspection of all allotment holders in each district, and by pruning demonstrations and competitions.[6]

(8) *Rural Education.*—It is impossible for a Farm Institute to keep itself aloof from the big question of rural education. As a first step, the aim at "Oaklands" has been to enlist the sympathy and co-operation of the elementary school teachers in the county. With this end in view, a rally of these teachers is held at "Oaklands" each year, when subjects of mutual interest are discussed. It is hoped in the near future to hold a similar rally for secondary school teachers.

More concrete assistance is given in two types of courses given by the Institute Staff:—

(*a*) Teachers' Course in Horticulture, at "Oaklands."
(*b*) Teachers' Course in Rural Science, in the County.

The former course is held on Saturday mornings at different seasons and culminates in a one week's residential course at the Institute in the summer. It is designed to help teachers to make the fullest use of their school gardens as an aid to ruralizing the curriculum in country schools. The latter course has lately been started in two districts. Its object is, through the teachers, to foster a love of country life, and to stimulate the desire for further education in rural affairs. In one centre, also, a young farmers' club has been formed. These steps, however, must be looked on as preliminaries, and much time and thought are now being devoted to the preparation of a scheme to augment and link them up with continuation classes in rural districts for boys and girls between the ages of 14 and 16.

Conclusion.—Throughout this article emphasis has been laid on the phase of agricultural education which relates to farmers and farmers' sons, while horticulture and poultry keeping have only had casual mention. At "Oaklands" both these subjects are dealt with in the same way as that described above. The instructors in both are also responsible for commercial departments at the Institute. In the case of the poultry plant, financial success has been secured from the start[7]; with horticulture the commercial side was developed later, but already estimates are based on securing a profit. Through both these departments, contact is maintained not only with the strictly rural areas, but also with many

urban districts. The chain of progress, the lines of action, and the ideals aimed at are precisely similar to those in operation on the agricultural side.

Reviewing the work done in the county, there is no doubt that very substantial progress has been made in the short space of five years. It certainly has been a severe strain on the staff to maintain all the necessary activities—administrative, commercial, educational and advisory—but the results have justified their efforts. An edifice of progressive thought and enterprise has been built up which cannot fail to leave its mark on the county.

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[3]*Lamb Production from Grass Flocks.* This JOURNAL, August, 1926. p. 403.

[4]*Necessity for Lime or Chalk in Hertfordshire.* Bulletin No. 3. Issued by the Institute.

[5]*A Simple Guide to the Purchase of Feeding Stuffs and the Compiling of Rations for Dairy Cows.* Second edition. Issued by the Institute.

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MONTGOMERY AND CORNISH MARL RED CLOVER

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THE seed of Cornish marl red clover is produced exclusively in Cornwall, chiefly in the Mawgan, St. Columb, Wadebridge, St. Minver, and adjoining districts. The soils on which the crops are grown are generally of a calcareous nature, particularly in the coastal districts; hence the suffix "marl." The valuable qualities of the variety are often attributed to the fact that it has been grown for a great number of years on marly soil. Cornish marl, like all other red clover varieties and other leguminous species, is a lime-loving crop and will only give the best returns on soil relatively rich in this ingredient; it is, however, capable of producing excellent crops on soils which are known to be more or less deficient in lime.

The seed growing of Montgomery red clover is confined to a comparatively small area in the east of Montgomeryshire and extending for a few miles into Shropshire, with Montgomery, Welshpool, Forden Berriew, and Kerry as the

principal centres in Montgomeryshire, and Chirbury and Westbury in the latter county. Most of the seed crops are grown on moderately heavy soils, but equally good crops are obtained on fairly light land.

Historical.—It is definitely known that the two varieties have been grown continuously in their respective areas for over 60 years, but their exact origins are still obscure. The view sometimes expressed that Cornish marl originated as a result of natural crossing between ordinary red clover (*T. pratense*) and zigzag clover (*T. medium*) is totally erroneous. The theory is untenable for two reasons: in the first place, Cornish marl does not possess a single character which suggests that it is of hybrid origin; and, secondly, ordinary red and zigzag clovers are completely cross-sterile. Several attempts have been made by the writer to intercross the two species, but without any success.

It is possible that Montgomery and Cornish marl may have originated from natural crosses between ordinary cultivated red and wild red clovers. In the main, the indigenous wild red clovers are earlier, smaller, less leafy, and altogether inferior for fodder purposes to the cultivated varieties. A few types have, however, been found in Montgomeryshire, Cornwall, and various other districts which are distinctly later than the broad red clover, and which resemble the cultivated late varieties fairly closely in certain characteristics, such as leafiness and high "tillering" capacity.* When laying down land to grass, it used to be the practice, at least on some farms in Montgomeryshire two or three generations ago, to sow hay sweepings to which some home-grown red clover seeds were added. The hay sweepings would be expected usually to contain a small proportion of seeds of wild red clover, and consequently a certain amount of intercrossing between wild and cultivated forms would inevitably occur when the fields were kept for seed. More wild red clovers would be introduced at each sowing, and as the number of wild red × broad red clover crosses and their segregates increased, the strain may be supposed to have been gradually changed in the direction of greater longevity. It is probable that this process was considerably accelerated when it became the practice to harvest the second and third year crops, for only the seeds from the most permanent plants would be saved.

* In the absence of a more appropriate term, "tillering" is used in this article to denote the development of the main stems in red clover.

Seed Production.—When crops are intended for seed, they are usually sown alone, in which case the usual seeding is 8 lb. to 12 lb. per acre, or with Italian rye-grass, when the average seeding is 8 lb. to 10 lb. of red clover and 2 lb. to 4 lb. of rye-grass. Occasionally a complete mixture of grasses and clovers is used.

The age at which the crops are first harvested for seed and the subsequent treatment of the fields differ greatly from farm to farm, even in the same district, and depend mainly on the system of crop rotation employed. In some cases, the crops are seeded in the first (harvest) year, and are then either ploughed up or kept for seed in the second year; but in most cases they are mown for hay in the first year, then seeded in the second year, sometimes again in the third year and occasionally in the fourth year. It is by no means an uncommon practice to take two and even three successive seed crops from the same root. The following figures represent the percentage acreage of Montgomery and Cornish marl harvested for seed in the first, second, third, fourth and subsequent years in 1926 :—

	1st year	2nd year	3rd year	4th to 6th year
Montgomery ..	30·8	53·0	11·9	4·3
Cornish marl* ..	—	81·9	9·5	8·6

* The figures for Cornish marl were kindly supplied by Mr. Basil Jenkins, Assistant Organizer for Cornwall.

The fields are closely grazed up to about the end of May before putting them by for seed. It is only very occasionally that the first crops are cut for hay and seed taken from the second growth. Unless the crops are mown early in June, the aftermath will either not flower at all or will flower too late to produce a seed crop. When grazed up to the end of May, the crops are usually in full bloom at about the end of July or the beginning of August. The time of harvesting depends necessarily on weather conditions, but in normal seasons the seeds are usually ripe by the first or second week in September.

The yields from the first and second year leys are considered to be somewhat similar. If the fields have been given a dressing of phosphatic manures during the previous winter, the third year leys are often quite as productive as in the first year, but after the third year the yields fall off rapidly. The yield of seed varies very considerably according to the season; for instance, the average crop in 1924 was only ½ cwt. to 1 cwt. per acre, while in 1925 as much as 5 cwt. per acre were obtained.

The average yield of dressed seeds over a run of years is about 2½ cwt. to 3 cwt. per acre. The number of acres of genuine Montgomery and Cornish marl seeds harvested during the last few years were :—

	Montgomery	Cornish marl
1923	245	—
1924	174	102
1925	112	130
1926	232	127

Chief Characteristics.—All red clover varieties may be classified into three main groups, namely :—

(1) Wild.
(2) Early-flowering or broad red clover, as, for example, English broad red, Chilian, Canadian, American medium, Brittany, New Zealand, and many others.
(3) Late-flowering or single-cut red clover, as, for example, English late, Montgomery, Cornish marl, Altaswede, American Mammoth, Swedish, Danish, and Norwegian lates.

The late-flowering varieties differ from the early-flowering clovers in many important characteristics, but from the farmer's point of view the chief difference is that the latter behave in the main as biennials, while the former are more perennial. All the late varieties are capable of producing good crops in the second year as well as in the first, while a few will even last well for three or more years.

It will be shown later that Montgomery and Cornish marl are very similar in regard to their productivity and persistency. They are so similar in other characteristics—as, for example, "tillering," habit of growth, size of the leaves, and time of flowering—that to all intents and purposes they may be regarded as the same variety. In the seeding year the plants form short, dense, leafy growth and, unless sown very early, they will flower only sparingly or not at all. They remain throughout the winter and early spring in an almost dormant condition. In this stage the crowns are well protected by a thick covering of radical leaves, which give the plants their characteristic tufted appearance during this period. They differ greatly from the early-flowering and some of the other late varieties in this respect. In the case of most of the broad red clovers a certain amount of growth occurs throughout the winter except during cold weather, with the result that the crowns are more or less exposed to frost. The fact that Montgomery and Cornish marl are better protected during the dead season is, probably, one of the chief reasons why they are more persistent than most of the other red clovers.

With the exception of Norwegian and some of the Russian lates, Montgomery and Cornish marl are later in starting active growth in the spring than any other variety. As a rule, they seldom make a start before the third or fourth week in April. Thus, they are about two weeks later than English late and about four to five weeks later than English broad red clover.

Although they make very rapid growth during the early summer, they are essentially late-flowering clovers. They are usually in the full-bloom stage during the fourth week in July—that is, at about the same time as American Mammoth and Norwegian late—but about two weeks later than English late, and about four weeks later than English broad red. When they are cut at this stage, the aftermath growth is invariably very small.

When grown as spaced plants, they are usually prostrate to semi-prostrate in habit of growth during the early stage, but they become semi-prostrate to semi-erect towards the flowering stage. Under field conditions, they are forced, owing to competition with other plants, to assume a more erect habit. The stems, which are long and usually well-branched, are more numerous, more slender, and rather weaker than in other varieties; also the leaves are smaller than those of most other red clovers, and decidedly smaller than those of English late and broad red clovers. In common with many of the other late varieties, Montgomery and Cornish marl have, in all stages, a more leafy, uniform growth and a fresher green appearance than the early-flowering varieties.

Hay and Aftermath.—In recent years a large number of trials have been conducted at Aberystwyth and other centres in Wales to compare the cropping qualities, and the persistency, of about twenty varieties and nationalities of red clovers. It is outside the scope of this article to consider in detail all the different varieties included in these trials. In order to have a clear perspective, however, of the value of Montgomery and Cornish marl, it is necessary to compare the results given by these two clovers with those obtained from some of the other most productive varieties commonly grown in this country. The varieties selected for this comparison are English late, English broad red, and Chilian; and, in order to emphasize the danger of using foreign varieties which are not adapted to our conditions, the results given by Italian red clover are also shown.

The results given by these six varieties in the various trials conducted at Aberystwyth are summarized below. These trials were carried out on light and medium soils, some of which were deficient in lime. In all cases, except in trials A 81 and A 85 III, the clovers were sown alone. In A 81 they were sown with timothy and in A 85 III with perennial rye-grass. In each trial the plots were sown at a uniform rate, based on the same number of germinating seeds per acre, and each variety was replicated several times. To facilitate comparison, the yields of pure clover of the different varieties are expressed as percentages of those given by Montgomery (or Cornish marl in one trial in which there were no data for Montgomery).

Seeding Year.—In appraising the relative suitability of the different varieties of red clover for certain purposes—for example, for inclusion in one-year leys—due account has to be taken of their productivity during the seeding year, especially of the amount of stubble grazing they afford. Generally speaking, the slow-growing varieties, such as Montgomery, Cornish marl, Swedish, and Norwegian late, are less productive in the seeding year than most of the early varieties and English late. This is indicated by the following figures, which represent the relative yields in the seeding year of a few of the varieties included in two trials sown without any nurse crops in 1920 and 1922. The 1920 trial was sown in April and mown in September, while the 1922 trial was sown in May and mown in October.

Year	Mont-gomery	Cornish marl	Nor-wegian	English late	English broad red	Chilian
1920 ..	100	80	50	140	156	135
1922 ..	100	—	—	133	119	103

When the clovers are sown under a cover crop, the superiority of English late and English broad red is even more marked than is indicated by the above results. By virtue of the fact that they are able to recover much more quickly after the cover crop has been cut, they almost invariably produce much more autumn grazing than Montgomery and Cornish marl, particularly after a late harvest. It should, however, be mentioned that after an early harvest the latter usually produce quite an appreciable amount of dense, leafy growth.

As already explained, Montgomery and Cornish marl produce but very little winter growth. Consequently, for winter and spring grazing they are much inferior to most of the early red clovers. For instance, in two trials, sown in

1922, English broad red on the average produced 2,150 lb. per acre of green fodder, and Chilian 1,100 lb., from about the middle of October to the middle of March, 1923, while Montgomery produced only 410 lb. per acre during the same period.

First Harvest Year.—The relative aggregate yields of hay and aftermath produced by different varieties of red clover during the first harvest year are shown in the following table :—

TABLE I

Trial No.	Year	Montgomery	Cornish marl	English late	English broad red	Chilian	Italian
A 1	1920	—	100	127	100	92	24
A 14	1921	100	134	180	175	106	92
A 19	1921	100	114	104	111	86	38
A 39 I	1922	100	—	98	67	57	5
A 39 III	1922	100	82	87	49	—	—
A 39 V	1922	100	111	107	62	48	20
A 81	1924	100	—	—	35	38	—
E 37	1924	100	—	63	47	—	—
A 85 III	1925	100	97	111	70	—	—
A 109	1926	100	—	—	76	—	—

On reference to Table 1, it will be seen that, relatively, both Cornish marl and Montgomery gave exceedingly good crops in the first year, the former being on the whole slightly the more productive. Though they gave better crops than English late in several trials, on the average they were slightly less productive than this variety. The results prove conclusively that, for the conditions under which these trials were conducted, Montgomery and Cornish marl may be relied upon to produce, in spite of the shorter growing season, far heavier yields of hay and aftermath in the first year than even English broad red, which in these trials proved to be one of the most consistent croppers of the early clovers. The relatively low yields of Montgomery and Cornish marl in 1921—the only year in which these two varieties were surpassed by English broad red and Chilian—were directly due to the effect of the severe drought which occurred that year. The drought, which lasted practically from the middle of April to the end of July, set in before the late varieties, but after the early clovers, had started active growth. The results of these and other trials conducted at various centres in Wales agree in the main with those

obtained at Aberdeen,* where it was found that the Welsh red clover (that is, Montgomery) produced, on the whole, heavier hay crops than any of the other varieties and nationalities tested, even in the first year.

The amount of hay given by any variety depends to a large extent on the time of cutting. In the case of Montgomery, it has been found that, although the heaviest yields of hay are obtained when the crops are mown at the full-bloom stage, it is quite immaterial, as far as the aggregate yields of hay and aftermath are concerned, when the hay is mown, provided it is not cut before about the third or fourth week in June, when the clovers are in the late-bud stage, and not later than the fourth week in July, when they are in the full-bloom stage. The increased yield of hay resulting from late cutting is counterbalanced by a proportional decrease in the aftermath and *vice versa*.

On the other hand, the quality of the hay depends, to a great extent, on the time of cutting. The hay from Montgomery clover, mown at about the beginning of July is more leafy and succulent, and of higher nutritive value, than that mown two weeks later. Apart from the question of quality of the hay, it is important for another reason that hay crops containing a large proportion of late-flowering clover should be cut early. These clovers generally tend to become badly laid during the early flowering stages, Montgomery and Cornish marl being the worst offenders in this respect. On this account it is always advisable to cut crops containing these two clovers before the end of June. Even when they are mown three to four weeks before the full-bloom stage, these varieties will generally give better and heavier crops of hay than the early clovers.

Neither Montgomery nor Cornish marl will produce much second growth after a late hay cut, but when mown early the aftermath crops compare favourably with those of broad red on most soils, and are distinctly better on the poorer soils and in exposed districts. For example, the weights of hay and aftermath obtained as green fodder from Montgomery and English broad red plots, which were cut early in July

* "Red Clover," Wm. M. Finlay, North of Scotland College of Agriculture, *Bulletin* 24, 1919; and "Report on Grass Seed Mixtures, 1907-1913," North of Scotland College of Agriculture, *Bulletin* 30, 1926.

of the first harvest year (1926) and again in the middle of September, were :—

	Montgomery Cwt. per acre	English broad red Cwt. per acre
Hay	165·7	110·7
Aftermath	112·7	80·6

Second Harvest Year.—The relative aggregate yields of hay and aftermath given by different varieties of red clover in the second harvest year are shown in the following table :—

TABLE II

Trial No.	Year	Mont-gomery	Cornish marl	English late	English broad red	Chilian	Italian
A 14	1922	100	102	103	56	25	0
A 39 I	1923	100	—	60	5	1	0
A 39 III	1923	100	96	64	23	—	—
A 39 V	1923	100	115	52	5	2	0
A 81	1925	100	—	—	33	12	
E 37	1925	100	—	62	27	—	

In all the trials, with the exception of one (A 14), Montgomery and Cornish marl produced far heavier crops in the second year than any of the other late varieties ; these last, in turn, were greatly superior to all the early-flowering varieties. In some of the trials, the early varieties had died off to such an extent during the previous winter that their contribution in the second year crops was almost negligible.

On light soils, particularly if they are deficient in lime, the productivity of even the most persistent clovers is generally considerably less in the second year than in the first. On the lime-deficient soils at Aberystwyth, the yields of Montgomery and Cornish marl in the second year were, in extreme cases, 37 to 40 per cent. less than in the first year. The corresponding reduction in the yields of English late ranged from 19 to 23 per cent., and, in the case of English broad red, from about 3 to 4 per cent. However, on the better class land the second year crops of some of the late varieties were sometimes quite as bulky as those of the first year.

Third Harvest Year.—The relative aggregate yields of different varieties of red clover in the third harvest year were as shown in Table III. The results shown in this Table suggest that, at Aberystwyth, Montgomery is more productive in the third year than Cornish marl, but in the various trials conducted in the counties both have given on the

TABLE III

Trial No.	Year	Montgomery	Cornish marl	English late	English broad red	Chilian	Italian
A 14 ..	1923	100	88	66	35	28	0
A 39 V ..	1925	100	70	61	0	0	0

whole fairly similar results, Cornish marl being slightly superior in some, and Montgomery in others. In most cases, all the varieties—both late and early—with the exception of Montgomery, Cornish marl and English late, had died back completely by the third year.

Persistency.—On several trials, from which no third year yield data were obtained, actual counts of the number of plants were made before the plots were ploughed, in order to ascertain the persistency of the different varieties. The average results in the three main trials are shown in Table IV. In two of these trials, the counts were made during the late spring of the third year and in the other in the spring of the fourth year. The average number of live plants per square yard of different varieties of red clover in the third and fourth harvest years are shown in the following table :—

TABLE IV

Trial No.	Harvest year	Montgomery	Cornish marl	English late	English broad red	Chilian	Italian
A 39 1 ..	3rd (1925)	51	—	33	8	4	0
A 81 ..	3rd (1926)	68	—	—	7	4	—
A 39 V ..	4th (1926)	29	31	10	2	0	0

The figures given in Table IV prove conclusively that in these trials Montgomery and Cornish marl were more persistent than the other four varieties included. Similar evidence obtained for the other clovers shows that these two are much more lasting than any of the 22 varieties and nationalities tested in these trials.

The greater persistency of these two varieties is now fairly generally recognized. Numerous instances may be quoted

where they give excellent stands in the third and, in many cases, in the fourth year. In the seed-growing areas of Montgomeryshire and Cornwall, four, five and six-year-old crops are by no means uncommon, but in view of the fact that a considerable amount of seed is shed during harvesting, particularly in wet seasons, it is possible that many of the old clover fields in the seed areas may have become re-established as a result of self-seeding.

Productivity under Grazing Conditions.—As a result of several trials, conclusive evidence has been obtained that the late-flowering clovers are able to withstand grazing conditions better than the early varieties. The results further suggest that Cornish marl and Montgomery are the most suitable for this purpose. For example, one experiment, in which the plots were cut every 28 days for seven and four consecutive months during the first and second growing seasons respectively, so as to resemble grazing conditions, gave the following relative aggregate yields :—

	Mont-gomery	Swedish late	English late	Wild	English broad red	Vale of Clwyd
First year ..	100	100	65	62	35	43
Second year ..	100	45	36	91	negli-gible	negli-gible

Cornish marl was not included in this trial, but from observations made on other trials it is obvious that it behaves very similarly to Montgomery under pasture conditions.

Resistance to Various Diseases.—It is sometimes claimed that Montgomery and Cornish marl are completely immune from clover " sickness " (due to *Tylenchus devastrix* and *Sclerotinia trifoliorum*). The relative resistance of different varieties and nationalities of red clover to the eelworm and stem-rot diseases is being investigated by Rayns* in Norfolk, and by Wakerley† in Lincolnshire, and valuable information has already been obtained with regard to this important problem. Wakerley, in his trials, found that none of the red clovers tested—namely, Vale of Clwyd, Suffolk broad red, Dorset marl, Lincolnshire broad red, Chilian and Montgomery—was immune, but of these Montgomery and Dorset marl proved to be the

* The writer wishes to express his gratitude to Mr. F. Rayns, Director of the Norfolk Agricultural Station, for supplying him with full particulars concerning these investigations, the results of which have not yet been published.

† Report on experimental demonstrations for the year 1924, F. Wakerley, Kesteven Agricultural Committee.

least susceptible. The average relative results of similar trials carried out by Rayns at two different centres are shown below. These trials were sown in 1925. In the autumn and the following spring. actual counts were made of the number of plants, of each variety, that had become infected. The plots were mown for hay and the green weights of the produce taken.

	Relative No. of infected plants Broad red = 100	Relative weight of hay Broad red = 100
English broad red	100·0	100·0
Chilian	79·5	99·9
Vale of Clwyd	54·9	110·8
Montgomery	65·0	167·1
English late (Norfolk)	52·0	166·1
„ „ (Cotswold)	55·5	167·7

It is evident that in these trials Montgomery was decidedly more resistant than the three early clovers included, but was slightly more susceptible than the two English late clovers.

Although it has been found that Montgomery is not completely immune from clover sickness when grown on infected areas in the east of England, it is, however, a well-known fact that this clover has been grown continuously for over forty years, in four and five-course rotations in parts of Montgomeryshire and Shropshire, without the land becoming in the least infected, and that it has been grown successfully on farms within this area when other varieties had completely failed. It should, however, be noted that, for reasons which are at present little understood, the coastal western counties are practically free from clover sickness, only a few isolated eelworm and stem-rot attacks having been reported.

In Wales, the two diseases which cause the greatest damage to red clover are anthracnose (*Gloeosporium caulivorum*) and leaf spot (*Pseudopeziza trifolii*).* Anthracnose disease is often responsible for very considerable damage to seed crops, but, as its maximum attack does not occur until the plants are flowering freely, serious damage to the hay crops may often be avoided by cutting the hay early. In recent years the leaf-spot disease has caused considerable damage to hay crops at Aberystwyth. It was very prevalent in 1923 and 1925,

* For fuller information concerning these diseases see "Preliminary Investigations with Herbage Plants," Welsh Plant Breeding Station, *Bulletin H* 1 (1919-21); "'Scorch,' or *Gloeosporium* Disease of Red Clover," W. M. Ware, Vol. XXX, No. 9 (1923), of this JOURNAL; *Comparative Studies of Kabatiella caulivora*, Kirch, Karak, *and Colletotrichum trifolii*, Bain and Essary, *Two Fungi which cause Red Clover Anthracnose*, Kathleen Sampson (in the press).

and was largely responsible for the poor yields obtained from the early-flowering clovers in those years.

Although Montgomery, Cornish marl and other late varieties are by no means immune from these two diseases, they are certainly much less susceptible to them than the early-flowering clovers.

General Considerations.—The early-flowering varieties, such as broad red, are generally considered to be more suitable for sowing in one-year leys than the late clovers, partly because they afford better stubble winter and spring grazing, and partly because they produce two full crops during the following season. Although it is possible that, in certain districts and on certain types of soil, broad red may produce, in the first year, heavier crops than the late varieties, yet it is very probable that English late, Montgomery or Cornish marl may be used to better advantage on many farms where broad red is now exclusively sown. The results of various experiments, carried out in Aberdeen, Leeds,* and Devon,† as well as at Aberystwyth and other centres in Wales, all proved that, at least in these districts, the home-grown, late-flowering clovers are usually much more reliable, even in the first year, than English broad red, while the results of the experiments in Norfolk and Lincolnshire have demonstrated that they are also more suitable for soils subject to clover sickness.

As far as the writer is aware, there are no exact experimental data available for drawing a direct comparison between the relative effects of the different red clover varieties on soil fertility, but it is sometimes claimed that Montgomery and Cornish marl are superior to most other clovers in this respect. Although it remains for future investigation to show to what extent this claim is justifiable, there is no doubt about the high standard of productivity of the land, as reflected by the heavy crops obtained, where these two clovers have been grown for a number of years.

For two-year leys, the late-flowering clovers should be sown in preference to the early types. Of the late clovers, the three native varieties are the most reliable for this purpose. English late is generally the most productive in the first year, but in the second year it is usually surpassed by Montgomery

* "Report on Nationalities and Varieties of Red Clover," W. G. Smith, University of Leeds, *Bulletin* 57, 1906.

† "Grass and Clover Seeds Mixtures," D. B. Johnston Wallace, *Essex County Farmers' Union Year Book*, 1925. *Scheme of Agricultural Education and Guide to Experiments*, Colin D. Ross, Devon County Agricultural Committee, 1926.

and Cornish marl, which, on account of their greater persistency, should always be included in mixtures intended to be down for three years or longer.

Montgomery and Cornish Marl Seed-Growing Associations.—Until quite recently, the terms "Montgomery" and "Cornish marl" were applied in a loose way to all red clovers—irrespective of the variety—harvested for seed in these two counties, with the result that a considerable proportion of the seeds sold as such were not the true extra-late Montgomery and Cornish marl strains. Fortunately, this unsatisfactory state of affairs has now been remedied. Within the last four years, the growers in both these areas have formed themselves into associations for the express purpose of ensuring the genuineness of the crops grown for seed. This is effected by annual inspection of the growing crops, when all those which do not conform to the standard type are rejected, and only those which are pure and true to name are certified as genuine. The annual lists of growers may be obtained from the honorary secretaries of the associations:—Mr. C. James, Brynawel, Montgomery, and Mr. Hoskings, Town Mills, St. Columb, Cornwall.

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CHARACTERS WHICH DETERMINE THE ECONOMIC VALUE OF GRASSES

III. TILLER PRODUCTION AND POWERS OF RESISTANCE TO REPEATED DEFOLIATION

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THE continuous production of leafage must, in the light of recent investigations and of what has been stated in previous articles of this series, be regarded as the *sine qua non* of a valuable pasture grass.

Leaf production is, in the last resort, a function of tiller production, while it is to be supposed that grasses which tiller freely would be more likely to be able to withstand heavy grazing than those which tiller but poorly. Work with cereals has shown, conclusively, that tiller production is difficult to study and is influenced, to a marked degree, by agronomic conditions—by spacing and depth of sowing, for example—as well as by the ordinary environmental factors of soil and climate.

Progressive Tiller Development.—The relative potential tillering capacity of different species and strains can, however, be studied by growing plants under such conditions as to give scope for maximum production. This has been done, in the case of a number of grasses, with a view to the study of progressive tiller development. The procedure was as follows. The seeds were sown in boxes on February 28, 1923, and started in a cool house. On April 16, the boxes were sampled and 100 seedlings for each lot counted for tillers. The seedlings were planted out, on June 13, as widely spaced plants. On this date 100 seedlings were again counted for tillers. On August 28, 25 plants were lifted from each lot and the tillers again counted. The remaining plants, for the majority of species and strains, were then allowed to grow on until at or about the heading stage, at which time they were assumed to have attained to an adult condition; 25 representatives were dug from each lot, on May 9, 1924, and the tillers again counted. The results of these counts are given in Table I.

TABLE I.—To show the progressive Tiller Development from seedling to heading stage for 15 different strains and species of grasses.

Species and strains	Number of tillers per plant			
	Apl. 16, 1923	June 13, 1923	Aug. 28, 1923	May 9, 1924
Cocksfoot—Indigenous ..	1·6	8·1	152	211
„ Commercial ..	1·0	5·2	73	105
Perennial rye-grass—				
Indigenous	1·7	18·3	445	557
„ „ Commercial	2·0	14·9	388	443
Timothy—Indigenous ..	1·3	8·8	156	218
„ Commercial ..	1·0	5·3	52*	70*
Tall oat-grass—Indigenous ..	3·1	10·6	129	307
„ „ Commercial ..	2·3	5·2	69	142
Red Fescue—Indigenous ..	2·0	31·7	358	993
Hard Fescue—Commercial ..	1·8	39·8	269	435
Meadow Foxtail—Indigenous	1·4	15·7	103	262
„ „ Commercial	1·6	15·0	108	150
Meadow Fescue—Commercial	1·9	8·9	137	263
Rough-stalked meadow-grass—				
Commercial	2·0	19·8	583	728
Sweet vernal-grass—Indigenous	1·9	18·0	214	785

* The Commercial Timothy plants were very badly rusted at this stage.

Rough-stalked meadow grass, indigenous sweet vernal grass, red fescue, and the perennial rye-grasses will be seen to have

outstanding capacities for tiller production, while commercial timothy, commercial tall oat-grass and commercial cocksfoot are relatively poor in this respect. Meadow fescue shows to poor advantage when compared to the two rye-grasses. The outstanding tillering capacity of the indigenous strains, compared with the commercial, is noteworthy and is in complete harmony with all the earlier trials reported from the Station. Of the species under review, ordinary commercial timothy, tall oat grass and cocksfoot, all with relatively poor tillering capacity, are essentially hay grasses which do not normally withstand heavy grazing. Under suitable soil conditions, high-tillering plants, like rough-stalked meadow grass and perennial rye-grass, are competent to withstand heavy grazing. That tillering capacity is not, however, an absolutely safe guide to capacity for withstanding heavy grazing is, perhaps, suggested by the fact that red fescue is probably not a grass which often assumes a dominant position on heavily grazed pastures.*

Tillering appears to take place at an early stage in the case of most of the grasses, but varies considerably in rapidity of development. The figures would suggest that, relative to maximum tiller development, the perennial rye-grasses are among the most rapid tiller producers, while rough-stalked meadow grass is also noteworthy in this respect; two species, be it noted, which, perhaps to a more marked degree than any of the other valuable pasture species, are competent to develop a dense sole to a sward.

The Effect of Repeated Cutting on Tiller and Root Development.—The retarding influence of repeated cutting on the production of potential panicle tillers has already been alluded to; while the effect on tiller production as a whole has been previously reported upon from the Station. It was thought desirable, however, to repeat the earlier trials and to include a larger number of species. The results from trials with single spaced plants, subject to pre-treatment in 1924, and harvested in 1925, are set out in Table II. Data for weight of roots and weight of stem and leaf together, are also shown in the table.

The significance of the figures is manifest, for, without a single exception, hay weight, number of tillers, and root weight

* It is unfortunate that Yorkshire fog, the bent grasses and crested dogstail species, upon which no breeding work is being conducted at the Station, had not been brought into the various agronomic investigations. Yorkshire fog and most of the bent grasses are, however, high-tillering species.

TABLE II.—To show (1) Yield of Hay, (2) Number of Tillers, and (3) Weight of Roots from plants harvested in 1925, respectively, for a series cut 11 times (pasture cuts) and for a series cut for hay and aftermath only in 1924.

Species and strains	Wt. of hay per plant in gms. dry wt.		No. of tillers per plant		Wt. of roots per plant in gms. dry wt.	
	Pre-cut 11 times	Pre-cut for hay and after-math	Pre-cut 11 times	Pre-cut for hay and after-math	Pre-cut 11 times	Pre-cut for hay and after-math
Cocksfoot—Indigenous ..	61·1	129·6	117·1	141·0	5·9	10·6
,, Commercial	37·4	93·9	41·3	82·7	3·8	7·2
Tall oat-grass—Indigenous	53·2	140·9	79·3	143·3	4·9	13·4
,, ,, Commercial	9·7	61·2	24·8	53·3	1·0	7·2
Perennial rye-grass— Indigenous	29·9	50·7	176·0	280·0	2·8	4·8
,, ,, Commercial	13·3	35·6	61·7	146·3	1·5	3·9
Meadow Foxtail— Indigenous	42·9	89·4	135·1	235·5	8·5	21·7
,, ,, Commercial	17·9	53·4	54·8	129·8	3·6	12·8
Timothy—Indigenous ..	67·5	171·5	97·2	116·0	4·7	6·1
Sweet vernal grass— Indigenous	19·8	61·3	142·0	332·1	4·6	15·8
Meadow Fescue— Commercial	14·6	61·4	49·5	97·6	3·2	6·6
Red Fescue—Indigenous	14·7	68·5	153·3	476·0	2·4	11·1
Average for all species and strains	31·8	84·7	94·3	186·1	3·9	10·1
Relative	37·5	100	50·6	100	38·6	100

have been decreased by a pre-treatment consisting of 11 pasture cuts. The magnitude of these decreases is rendered apparent by the relative figures at the foot of the table.

It is difficult, therefore, to resist the conclusion that heavy grazing, despite any residual effects from the droppings of the animals, cannot but help to weaken the plants chiefly selected by the grazing animal. This conclusion is the harder to resist because trials previously conducted at the Station have shown that a single heavy dressing of sodium nitrate was, at all events, not competent to narrow, materially, the margin between plants pre-treated on a pasture basis and those pre-treated on a hay and aftermath basis.*

* See Stapledon, R. G., and Beddows, A. R.: "The Quantitative and Qualitative Response of Cocksfoot (*Dactylis glomerata* Lin.) to Sodium Nitrate and to Superphosphate," *Welsh Journ. Agric.*, Vol. II, 1926.

Field plots at the Station have given evidence in the same direction and have shown reduction both of yield and of tillers, per unit of area, as the result of pre-treatments, consisting of grazing with sheep or cutting with a garden mowing machine, compared with the taking of a hay and aftermath crop. Relative results from the three treatments are set out in Table III.

TABLE III.—To show relatively the Yield of Hay and Aftermath in the second harvest year when following, respectively, (*a*) pasture cuts with a mowing machine; (*b*) intermittent grazing with sheep; and (*c*) a hay and aftermath crop. The effect on relative tiller production is also shown. Average figures for 24 species and strains replicated on 1/400th acre plots: first harvest year, 1924; second harvest year, 1925.

	Hay after hay	Hay after mowing machine	Hay after sheep
Relative yield of hay + aftermath	100	79	86
Relative tiller production..	100	75	87

It will be noted that the differences are not so great in the field plots as in the case of the single plants, but they are none the less definite and pronounced. It is interesting, also, to note that the effect on both yield and tiller production has not been so great on the plots intermittently grazed by sheep as on those cut monthly with the mowing machine. This fact is chiefly to be attributed to the more severe defoliation caused by the mowing machine, although it is likely to be influenced also by the manurial residues resulting from the sheep grazing. The effect of sheep grazing is, however, very largely a function of the heaviness with which the different species are in fact grazed. This is well shown by comparing tall fescue, a species which the sheep almost wholly neglected, with Montgomery red clover, which was defoliated by the sheep to a greater extent than by the mowing machine. The relative statement, hereunder, in respect of yield, compared with the average figures given in Table III, will make the position clear :—

	Hay after hay	Hay after mowing machine	Hay after sheep
Tall fescue	100	46	177
Montgomery red clover ..	100	73	59

It will be seen that, in the case of tall fescue, the highest yield in the second harvest year has been after sheep and not after hay and aftermath; the sheeped plots were hardly defoliated by the animals, but received a fair share of manurial residues from those having access to the sheep area as a whole.

The Montgomery red clover on the other hand, despite relatively heavy manuring consequent upon excessive grazing, has given an appreciably lower hay yield following sheep than following the mowing machine, although the latter treatment constituted relatively heavy defoliation without any manurial compensation whatsoever.*

From the evidence immediately under review, it would appear, therefore, that, because certain fields near a homestead, although heavily and constantly stocked, produce abundance of grazing, year after year, it is not legitimate to argue that heavy, continuous grazing does not weaken the plants which are most attractive to the grazing animal. Such an argument could only carry weight if it were shown by a system of control plots that those grazed on an intermittent basis, allowing of periodic unhampered leaf development, or those following after hay and aftermath, were no more productive than the plots continuously grazed.

It is true, of course, that swards accustom themselves to the conditions superimposed and the effect of constant heavy grazing cannot fail to do otherwise than eliminate species and strains incapable of withstanding the conditions.

The figures in Table II are themselves proof of selective influences, for, in practically all cases, the indigenous strains have withstood rigorous pre-treatment better than the commercial, and this whether the effect be estimated by yield, tiller production, or root weight. The point to be emphasized, however, is that the indigenous strains, no less than the commercial, have suffered from the pre-treatment.

Recent trials with a great number of pedigree indigenous strains of cocksfoot are very illuminating in this connexion. The results show that strains do, however, exist in which a sum of pasture cuts may outyield the sum of the hay and aftermath cuts. Out of 26 strains, tested in 1925, three behaved in this manner. In the second harvest year (1926) both the drills cut as pasture, and those cut as hay and aftermath, were allowed to grow on to hay and aftermath. It is interesting to note that the three strains which had given higher pasture yields than hay yields, in the first harvest year, gave higher hay yields after pasture than after hay in the second harvest year. This may be taken as showing that the three strains in

* The trial, from which this field evidence has been drawn, is now in its fourth harvest year and includes both indigenous and commercial strains of the chief grasses and clovers. It will be reported upon from the Station in detail in due course.

question were particularly well able to withstand constant cutting or continuous grazing. They were strains therefore of a character which might be expected to survive on a natural sward heavily grazed. The yields of these three strains are compared in Table IV with the average yields of the 26 strains under test, and also with the averages for the three highest yielding strains. The figures show that these "pasture" strains, although above the average, were not particularly high-yielding and were considerably lower in the scale than the best strains; and, although the difference was greatest in respect of hay yields, it was quite pronounced in pasture.

TABLE IV.—To compare the Yields of different pedigree strains of Cocksfoot under pasture and hay conditions respectively.
Gms. of dry fodder per metre drill.

Particulars	1925 (first harvest year)		1926 (second harvest year)	
	Sum of six pasture cuts	Sum of hay and after-math	Sum of hay and aftermath	
			When pasture in 1925	When hay in 1925
Average of 26 strains ..	206	323	207	251
Average of three strains in which pasture outyielded hay and aftermath and in which hay after pasture outyielded hay after hay	230	213	231	191
Average of the three highest yielding strains	288	584	272	441

It has, however, to be remembered that gross weight does not necessarily constitute a fair estimate of the stock-carrying or fatting capacity of herbage. It has been insisted that it is leaf production that matters—constant production of juvenile leaf. Constant cutting has been shown to increase the ratio of leaf to stem, but that is not to say that it increases the yield of leaf—it is only exceptionally that it does so.

The evidence referred to above does, however, suggest that constant cutting or heavy grazing may tend to select strains with a special capacity for the production of "leaf shoots" rather than of stem shoots. This view is further suggested by

the fact that in the case of the trials, alluded to earlier in this article, a particular indigenous strain of cocksfoot and a particular indigenous strain of tall oat grass, although producing less tillers under a pre-treatment of eleven cuts than under a pre-treatment of hay and aftermath, none the less produced more leaf shoots (non-stem tillers) under the former than the latter pre-treatment.

It is evident, therefore, that swards have an infinite capacity for reacting to the management superimposed upon them. Under ordinary conditions obtaining on permanent grasslands, this capacity is the more pronounced because the sward necessarily consists not only of numerous species but of numerous strains of each of the constituent species.

Practical Conclusions.—The practical conclusions to be drawn from the evidence brought forward in this and previous articles, and from the foregoing discussion, would seem to be as follows:—

(1) That heavy, continuous grazing of course converts leafage while in its most nutritive condition and on this account alone compensates for a certain necessary reduction in quantity.

(2) Such heavy grazing long continued, tends to select strains having to a high degree a capacity for the production of non-stem bearing tillers, and for leaf production, and on this account, too, tends to compensate for reduction in quantity.

(3) Long-continued heavy grazing almost certainly reacts adversely on the inherent productivity of the majority of the strains actually selected and, moreover, probably does not tend in the direction of necessarily selecting the most productive strains.

(4) Apart from the evidence brought forward, it is hardly on physiological grounds to be supposed that even grasses, despite their rather exceptional manner of growth, can withstand perpetual defoliation without suffering some harm.

(5) The benefits resulting from close grazing, in so far as the stock is concerned, can probably be obtained, without exaggerated harm to the plants and without undue selection in an adverse direction, by adopting a scientific method of intermittent grazing—resting and heavy grazing: a method also likely to give rise to a greater weight of nutritive leafage than one of constant depasturage.

The matters dealt with in this article will be again referred to in the next and closing contribution of this series in connexion with persistency and aggressiveness.

Thanks are due to Mr. A. R. Beddows, B.Sc., for the collection of much of the data on which the present article has been based and for the conduct of trials under review during the writer's absence in Australia and New Zealand. Thanks are also due to Mr. Wm. Davies, M.Sc., and Mr. W. E. J. Milton, N.D.A., for the collection and preparation of the field data which have been brought under review.

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TABLE-POULTRY PRODUCTION AS A FARM INDUSTRY

W. M. ELKINGTON.

THE production of table fowls is a branch of poultry culture that has failed to keep pace with developments in other directions. It may be that the growth of the egg-producing industry has had a deterrent effect upon the business of raising table chickens because it has tended to popularize a class of fowl whose edible properties are of small account; in addition to which there has been, and still is, a surprising lack of appreciation of the commercial possibilities of table-poultry production. The economic problems associated with the war, which necessitated the curtailment of this branch of the poultry business, appear to have left, in many minds, an impression that, at the best of times, the production of poultry flesh is a proposition beset with financial risks, and that it can only be regarded as a subsidiary operation necessitated by the inevitable presence of surplus cockerels.

Egg production is of more cosmopolitan character than the production of table poultry because the products are more easily handled and marketing facilities are more general, whereas the raising of table-poultry is influenced to some extent by local marketing conditions, and even more by means of access to centres where there is always a steady demand. We must not forget that poultry flesh is still regarded by many people in this country as a luxury, and for the present there is no prospect of supplies being large enough to ensure its adoption as a staple dish.

Profit in Table-Poultry—Contrary to popular belief, the profits from table-poultry production, under proper organization and with favourable marketing facilities, show a wider

margin than do those from egg production; and from the point of view of the general farmer there are several advantages, including a quicker turnover and a smaller capital outlay. In this case operations are confined largely to the first six months of the year, and there is no heavy outlay for housing and equipment as is necessitated by the management of a flock of layers. The table-poultry producer carries a comparatively small permanent stock for breeding purposes, and he turns over his money in a lump sum in three to four months from the date of hatching, instead of rearing pullets to the laying stage—say, six to seven months—and getting his turnover piecemeal.

Table-Poultry Production by the Farmer.—To get the best returns from a business of this kind, the farmer should take up table-poultry production on specialist lines—not necessarily on the same lines as the Sussex fatteners, who, in many cases, are not rearers and raisers, but rather he should breed specially for the production of table chickens instead of regarding this work as a mere side line for the disposal of the inevitable cockerels from stock bred primarily for the purpose of egg production. It is not suggested that useful table chickens cannot be raised from the egg-laying class of stock in such breeds as White Wyandottes and Light Sussex; but it is very clear that better margins of profit are realizable from birds bred specially for table qualities, and it is also evident that the specialist table-chicken raiser who commences operations early in the season will enjoy substantial marketing advantages over the more casual producer who is mainly concerned with the disposal of his unwanted cockerels.

Table-poultry production as a farm industry should be based upon a definite policy, which can be summed up briefly as catering for a specific demand. To put it more plainly, the producer should make it his business to ascertain what buyers require, and plan his operations accordingly. This is more important because market requirements may differ in various parts of the country, and it does not follow that London is the only centre that presents possibilities of market expansion. Producers will do well to investigate the conditions of local markets, which in many cases are well able to absorb regular supplies of limited quantity.

Necessity for Steady Supply.—Just as the egg merchant demands certainty of supply, so the table-poultry salesman requires some assurance of regularity, and there is plenty of scope for producers who will co-operate with salesmen in

order to build up a steady and remunerative trade. Any retailer will agree that in the early part of the year it is not a question of selling the goods but of getting them, and lack of home-raised chickens necessarily compels dealers to carry on a limited trade in cold-stored chickens of foreign origin. For this reason producers can count upon the co-operation of salesmen, if they are prepared, on their part, to tackle the business of production on systematic lines with a view to marketing regular supplies.

Time for Remunerative Trade.—It will readily be understood that the most remunerative trade in table poultry is done during the spring and early summer, when supplies are scarce and buyers are prepared to take a small chicken at a relatively high price. This branch of the trade offers plenty of scope to the specialist producers, but naturally it entails more trouble and risk in breeding, hatching and rearing. In order to commence hatching operations in December, it is necessary to maintain a stock of vigorous hens and early pullets from which a supply of fertile eggs can be relied upon at the right time. Incubators and suitable brooding accommodation for mid-winter chickens must also be available, and it will be understood that, while substantial reward awaits those who engage in these operations, there is need for something out of the common in the way of specialization, and the farmer who would raise table chickens successfully must have some ability in out-of-season breeding, hatching and rearing.

The Factor of Quality.—Apart from the production of early chickens, which, although a highly remunerative undertaking, may present difficulties of an insuperable nature to many, there is undoubtedly a great opportunity for the production of better class chickens later in the season, that is, from May onward. Supplies are still so scarce in May that a well-fed chicken, weighing 3 lb. to 4 lb., will always fetch a good price; but later on the markets receive so many consignments of what are obviously unwanted cockerels—many in poor condition and of inferior table quality—that dealers welcome supplies that bear the obvious mark of the specialist producer, and these will always command a comparatively high price. It is a matter of quality rather than of size, and since quality depends upon the breed, as well as upon the feeding, it is necessary to make a few observations upon these points.

Best Breeds for Table Production.—Even in these days of the egg-producing specialist, whose influence has been

stamped upon so many modern breeds, the table-poultry producer has a good selection without going beyond the breeds that are essentially of utility character. There are the Sussex—the Light, Speckled, and Brown—and the Faverolles, a breed whose excellent table qualities have not sufficiently been recognized. For smaller table chickens, of the *petits poussins* class, there is the White Bresse; while those who cater for a select *clientèle*, and aim to produce chickens that, in depth and width of breast, bear some resemblance to a partridge or a pheasant, will find an Old English Game or Indian Game cross with any of the above-mentioned breeds produce the desired result. Mr. J. H. Gilbert, who is in charge of the King's poultry farm at Windsor, and who is one of the most skilful producers of plump-breasted table chickens in this country, once informed the writer that a White Bresse male and Indian Game hens produced chickens of a remarkably fine quality, and though this cross may not appeal to those with whom rapidity of growth and low cost of production are first considerations, it may confidently be recommended to all who are desirous of catering for the highest class trade.

For those who desire to combine egg-production and table-chicken raising with one breed, under an economical general-purpose plan, the Light Sussex and the White Wyandotte stand out among the pure breeds, because there are many strains that have been cultivated specially for egg production whose edible qualities are well suited to the production of early table chickens. The Light Sussex has the advantage of white legs and flesh, a merit of considerable value in the London market; yet the White Wyandotte, despite its yellow shanks, is a good feeder, and fills out into an excellent table bird at about fourteen weeks. In a general-purpose scheme it may be worth while paying some attention to sex-linked crosses, particularly to the Rhode Island Red × Light Sussex, from which the male chickens inherit the leg and flesh colouring of the Sussex. Many people regard sex-linkage as a means of weeding out cockerels as soon as they are hatched, but it is significant that breeders who use the Rhode Island Red-Light Sussex cross make a point of selling off their day-old pullets from early hatches and retaining the cockerels for table purposes, the inference being that these are the more valuable members of the family.

Qualities for the Breeding Stock.—Methods of raising chickens for the table necessarily start with the assurance of

robust character in the breeding stock and generous treatment for the chickens, particularly during the early stages. The specialist table-poultry producer, when mating his stock, may not be much concerned with the laying records of his hens; but he makes certain that every bird in the breeding pen is thoroughly fit and capable of producing chickens that will grow well. For earliest hatching he may have to rely upon early pullets for sufficient eggs to fill his incubators; but, after the New Year, moulted hens should be in fit condition for breeding from, and these are likely to produce the sturdiest progeny.

System of Rearing.—The brooder-house system of rearing is specially well suited to the raiser of early table chickens because it affords adequate shelter and facilities for night feeding at a time of year when such advantages have an important influence on the rate of growth. Since early broods are comparatively small, as a rule, the indoor brooder answers the purpose very well, and excellent results can be obtained by converting a well-lighted outhouse into a brooder shed, dividing it into several compartments by means of fine mesh wire-netting, and placing a hover in each for 60 to 80 chickens. With ordinary care in management the birds will do well under these conditions, and two feeds by lamplight, say at 7 p.m. and 10 p.m., will have an excellent effect in promoting the growth and welfare of the chickens during the period of short days.

Feeding.—In regard to feeding, the average farmer enjoys an advantage as a chicken raiser through being able to utilize a quantity of skim milk, which is a valuable aid to growth and flesh production. When milk is available it should be included in the dietary from the time the chickens are a week old—either as a drink or for moistening the food. A considerable portion of moist or wet mash is essential for growing table chickens, and, in the case of *petits poussins* or early spring chickens, weight and condition depend more upon a generous diet throughout the rearing stage than upon any special fattening just before killing. With such materials as Sussex ground oats mixed with milk and served in troughs, with one feed of wheat each day, plump young chickens should be produced without any special cramming.

Cramming.—The business of cramming is a highly specialized branch of table-poultry production that is not, at this juncture, advocated for general farmers unless there are special circumstances that render it practicable. If farmers

are to be interested in raising table chickens as a farm industry we must set an ideal well within their reach, and the scheme for rearing chickens of the uncrammed class to meet a general demand calls for enterprise and industry rather than special skill. Moreover, it is based upon the concrete fact that the markets are in a position to absorb any reasonable quantity of well-fed chickens of the right class from March to June, while during the remainder of the year chickens of quality, bearing the mark of the specialist producer, will always hold their own in the market.

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NEW DAMAGE TO PEAS BY THE PEA MIDGE

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THE grubs of the Pea Midge (*Contarinia pisi* Winn.) have been known for a long time to the growers of peas. They are small, white and footless and are frequently found in the pods of peas in considerable numbers, usually from 30 to 40 in each pod. These grubs can "jump," and in some districts are known as "the white flea of pea pods." Most varieties of peas are attacked, especially Marrowfats.

Previous records of this midge have stated that only pods are attacked, but last year (1926), both in a garden at Cambridge and on an experimental plot at Wye, the flowers and the terminal shoots of peas were found to be infested with white grubs resembling those of the Pea Midge. On further investigation, a number of peas on allotments at Wye were found to be suffering in the same way. These grubs were carefully bred out and proved to be the Pea Midge (*Contarinia pisi* Winn.).

Nature of Damage.—About the third week in June, full-grown grubs were found in the flowers and a few adult midges were observed laying their eggs in the terminal shoots. The flowers which contain the grubs may be recognized by their being swollen, especially the bottom part of the sepals (Fig. 1). The petals are very crinkled and often scarcely show at all, the sepals on the other hand being of normal length. From 9 to 99 grubs were found in each infested flower. Damage by the Pea Thrips is very similar, but in this case the flowers are usually shrivelled up altogether. The attacked terminal shoots are

also very noticeable; the flower stems remaining about half an inch in length and all clustered together (Fig. 2). All the flowers in each case either produce no pod or else a very small mis-shaped one. As a result, this attack of pea flowers and shoots is more serious than when the grubs are found in the pods.

An estimate of the damage can be seen at a glance from the following tables, made after a detailed examination of rows of peas at Wye.

TABLE I.—THREE SOWINGS OF GRADUS PEAS ON EXPERIMENTAL PLOT AT WYE EXAMINED ON JULY 6, 1926.

	1st Sowing		2nd Sowing		3rd Sowing	
	Total	Per cent. attacked	Total	Per cent. attacked	Total	Per cent. attacked
Shoots—						
Attacked ..	35	7·0	19	4·8	13	2·1
Free ..	462		378		601	
Flowers—						
Attacked ..	143	41·3	228	35·9	241	18·7
Free ..	203		406		1,042	

TABLE II.—FOUR SOWINGS OF PEAS OF DIFFERENT VARIETIES ON ALLOTMENT AT WYE EXAMINED ON JULY 6, 1926.

	1st Sowing Quite Content		2nd Sowing Duke of York		3rd Sowing Dr. Kitchin		4th Sowing Marvel	
	Total	Per cent. attacked	Total	Per cent. attacked	Total	Per cent. attacked	Total	Per cent. attacked
Flowers—								
Attacked	40	31·3	38	25·5	10	23·3	0	—
Free ..	88		111		33		0	

From these two tables it will be seen that between 18 per cent. and 41 per cent. of the flowers were attacked, and in one case from 2 per cent. to 7 per cent. of the shoots were also infested. The loss of pods in each case would be very considerable. It may, further, be pointed out that the earlier sowings of peas suffered most, those varieties in full flower about the first week in July actually suffering the most. Those which had not flowered by this date were the most free, but those which had already podded were found to be attacked to a slight extent in the pods. The estimated infestation of the pods was 5 per cent.

Soon after July 6, the grubs "jumped" out of the flowers and shoots and fell to the ground, where they pupated. On July 14, the midges started emerging from the pupæ and continued hatching until the first week in August. These midges

FIG. 1.—Showing damage to Pea flowers.

FIG. 2. Showing damage to Pea shoot.

NEW DAMAGE TO PEAS BY THE PEA MIDGE.

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at once started laying eggs in any pods they could find. Thus, there had been at least two broods of the Pea Midge in the course of the year (1926); the adults of the first brood being on the wing during the last two weeks of June, while those of the second were on the wing during the last two weeks of July and the first week of August. The life-cycle of the second brood adults was roughly a month.

It is interesting to note that Lind, Rostrup, and Kolpin Ravn* have reported an attack of an unidentified midge on the shoots and flowers of peas in Denmark in 1913, which is probably this same midge. Similarly, Dr. Harrison† reported the grubs of a midge (*Contarinia* sp.) as attacking the terminal flowers and shoots of peas in Northumberland in much the same way as described in this paper. But, as the species of the midge was not stated, it is only a reasonable conjecture that it was the Pea Midge (*C. pisi* Winn.).

Control.—It is suggested that digging in naphthalene, at the rate of 3 cwt. per acre, between infested rows, will do a great deal towards getting rid of this pest. Handpicking the damaged flowers and shoots will likewise do good.

The writer is indebted to Mr. F. R. Petherbridge of the Cambridge School of Agriculture for sending him notice and material of the attack at Cambridge.

Summary.—The Pea Midge (*C. pisi* Winn.), besides attacking pea pods, also attacks the flowers and shoots.

The attacked flowers may be distinguished by the swollen base of the sepals which are of normal length, the petals being crinkled and shortened. The appearance is similar to that of flowers attacked by the Pea Thrips. In an attacked shoot the flower stems remain very short.

There are two broods per year of the midges; the first attacking pea flowers, shoots or pods, whichever are available at the time of emergence of the midges; the second brood attacking the pods.

Soil fumigation is recommended as a means of control.

* Lind, J., Rostrup, S., and Kolpin Ravn, F.: *Oversikt over Landbrugsplanternes sygdomme i* 1913. 79 Beretning fra Statens Forsögsvirksamded i Plantekultur, Copenhagen, No. 30, 1914.

† Harrison, J. W. H., *Entomologist*, Vol. LVII, p. 8, 1924.

CANKER IN FERTILITY PEAR TREES

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THE Fertility variety of pear, on account of its regular and heavy bearing, has been extensively planted in certain districts. Many growers, however, complain that this variety is so subject to canker, particularly when worked on seedling free pear stocks, that it is impossible to grow it as a standard tree.

A Cause of Failure.—Recent observations made at East Malling suggest one reason for the failure of this variety to develop satisfactorily into good standard trees. At the Research Station there is a trial plot of the Fertility pear, standard and bush trees worked on various stocks, the trees being now seven years old. During the spring of 1926, they came into leaf and flower apparently normally, but shortly afterwards, early in May, on many of the trees, a number of branches showed wilting leaves and flower trusses. The standard trees were far worse, in this respect, than the bush trees, for while many of the former had large branches (about three feet long), showing the disease, the trouble on the bush trees was comparatively slight. The most conspicuous examples were certain standard trees on which the main " leader " was dying back, as in the tree shown in Fig. 1, the head of the tree with withered leaves contrasting with the rest.

In every case examined, there were lesions caused by the pear scab fungus (*Venturia pirina*) at the lower end of the dying portion. Where a spur was killed, there were scab lesions on the spur itself or at the base where it joined the branch, and many of them showed, in addition, an obvious canker round the base of the spur. These cankers were still more evident on the affected branches, and, in every instance where a branch was dying back, there were present the comparatively superficial scab lesions and the more deeply penetrating cankers caused by the canker fungus (*Nectria galligena*).

The cankered areas on the branches were sometimes six inches long (Fig. 2). They bore numerous irregular cracks, in which the dark brown scab pustules could readily be seen with a lens. Some of the cankers also showed the whitish pustules of the " summer stage " of the canker fungus, and, on others,

FIG. 1.—A Fertility Pear Tree with dead branches. The leading branches at the top show the disease most conspicuously.

FIG. 2. The type of canker causing the disease. The irregular cracking of the bark is due to the Pear Scab fungus. The white pustules are the conidial fructifications of the canker fungus.

CANKER DISEASE OF FERTILITY PEAR TREES.

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such pustules developed in a few days on keeping the cankers in a moist chamber.

Canker and Scab Fungi Both Present.—In no case was any canker found on these trees without the presence also of the scab lesions. This fact suggests that, in this particular outbreak, the predisposing cause leading to the death of the branches was the infection of the young twigs by the scab fungus; this allowed the canker fungus to gain an entrance, through the scab wounds, and infect the woody parts, thus cutting off the upward flow of sap to those parts of the tree terminal to the cankers.

Wiltshire,* when studying the relation of scab infections to the incidence of cankers in apple trees, found that the canker fungus is able to gain an entrance through scab wounds, and the observations on the trees under consideration show that a similar result obtains in pear trees.

All parts showing definite evidence of infection by the canker fungus were cut away,† but there was still left a considerable amount of bark badly infected by scab, though not, at the time, showing canker. When the trees were examined in July, some weeks after the cankers had been removed, it was seen that the scab lesions which remained were quite superficial and were being cut off by a corky layer below. On rubbing the bark, the scaly layers were easily removed, leaving a healed scar.

Few of the standard trees were entirely free from cankers and one or more branches had to be cut out from most of them On the bush trees, however, canker was almost negligible; on these, with the exception of one tree from which one small branch had to be removed, the few cankers present were confined to small shoots or spurs. The probable explanation of the comparative freedom from severe canker attack shown by the bush trees is that these had been annually "leader-tipped" and spur-pruned, so that those parts of the young shoots, liable to infection with scab, were mostly removed during the ordinary pruning operations; the leading shoots of the standard trees, on the other hand, had been allowed to "run" for several years, and the trees had merely received slight thinning.

* Wiltshire, S. P.: "Canker Infection of Apple Trees through Scab Wounds," *Annals of Applied Biology*, IX, 1922, pp. 275-281.

† The writer wishes to take this opportunity of expressing his indebtedness to Mr. A. C. Painter, who personally cut out the cankered branches and recorded the number removed from each tree.

Influence of the Stock in Predisposing to Infection.—Whether the type of stock used has any influence on the degree of infection in this form of canker infection cannot, perhaps, be stated with certainty, but the records taken of the number of cankered branches removed from each tree suggest that, when grown as standard trees on certain stocks, Fertility pear trees are very susceptible. The stocks used for the standard trees in the trial plot, on which these observations were taken, were seedling hawthorn, mountain ash, wild service, white beam, common seedling pear, and seedling wild pear. One or more of the trees on each stock showed cankered branches and spurs, but those on common pear were, on the whole, far worse than those on other stocks. Two trees, the worst of all, were on this stock; from each of these two trees five large branches had to be removed together with a number of smaller branches, shoots and spurs. On the bush trees, the amount of canker was too small for the records to give clear indications that the type of stock had any influence on the degree of infection.

The trees on common and wild pear stocks had made the most vigorous growth, a fact which seems to indicate that growing this variety on a stock inducing vigour makes it more susceptible to attack by this form of disease.

Control Measures.—To summarize the foregoing observations, there are, at the Research Station, two sets of trees (both on a similar series of quince and free pear rootstocks), one set grown as standards with 4 ft. 6 in. length of stem, and the other as bush trees with a stem of 2 ft. Both sets are interplanted on this same experimental plot, the only difference in treatment being that the bush trees have had the leading branches tipped and the laterals spurred annually. The standard trees have been seriously crippled by canker, while the bush trees have been practically free from it.

It would appear, therefore, that the grower, who wishes to cultivate Fertility pears, has two alternatives: either to grow bush trees, on which the normal operations of leader tipping and pruning reduce, indirectly, the liability to scab infection and subsequent canker; or to grow standard trees, which cannot be so economically or effectively pruned and sprayed, and will also need considerable attention to keep them free from cankering.

The observations at East Malling go to show, clearly, how much more effectively canker in Fertility pears can be controlled

when the variety is grown as a regularly pruned bush ; it is this, rather than choice of stock, which is the deciding factor in producing healthy trees.

It must be remembered that scab itself causes serious disfigurement of the fruit, and systematic spraying, to control scab infection of fruit, leaves and shoots, should be routine practice. Since, as shown here, such infections on the shoots lead the way to canker, effective spraying against scab will also reduce canker. If, therefore, the grower decides on standard trees, special attention must be given to the spraying operations, particularly as standard trees soon get so tall that, to reach the uppermost branches, a high-pressure power sprayer is required. Bordeaux mixture is the best fungicide at present known for use against scab, and it can generally be used with perfect safety on pears. The first spraying should be carried out just before flowering and the second immediately the fruit is set. When trees have been seriously infested the previous year, or where subsequent canker infection is feared, later sprayings should not be neglected. If cankers make their appearance, they should, as a matter of course, be cut out at the earliest opportunity.

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MAY ON THE FARM

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The Root Break.—The sowing of mangolds is generally completed in April or early in May, but beet sowing continues during the first half of this month. Before June arrives, thought will be given to the side hoeing of the earliest sowings, for which purpose there are specially useful appliances that are still unknown in some districts. Land, that requires more cleaning and working than is consistent with the timely sowing and likely success of the above crops, is generally devoted to turnips or kale, unless its condition be such as to necessitate half or complete summer fallowing. With sprouted setts, potatoes may be planted considerably later than is advisable with ordinary seed.

In many districts, marrow-stem kale is taking the place of a considerable part of the acreage formerly devoted to swedes. The advantages of kale over swedes are that it is much superior as a cleaning crop ; it requires less horse and hand hoeing ; it can, if necessary, be left unsingled ; it is less subject to finger-and-toe and does not become mildewed after drought,

as do swedes when sown before June in warm districts or when the latter half of summer is drier than the first half ; it is more responsive than swedes to liberal manuring, and, as a food for milk production, it is richer in protein and mineral matter. Where sheep are fed on arable land, however, it is difficult to replace the swede crop for feeding after mid-winter. Marrow-stem kale becomes leafless and woody, and thousand-headed kale usually does not feed so many sheep per acre as does the swede crop. Swedes also can be lifted and pitted for use during hard frost and are perhaps more suitable for growing with artificials alone. Moreover, where half the root crop is drawn off the land, for feeding to bullocks in the yards, the swede lends itself better to this practice than thousand-headed kale.

Whether the crop chosen for May and June sowing be swedes or kale, the land requires skilful management at this time of the year to ensure a full plant and escape from the attentions of the turnip fly. One of the main considerations is soil moisture : what the soil contains must be carefully conserved, for little reliance may be placed on the benefit of rains until the crop has developed an extensive root system. "Spring rain only damps." With this object in view, the land should be worked in comparatively small strips rather than in large breadths. The size of the strip to be completed and drilled, before proceeding with the next, depends on the staff available ; commonly an acre is a convenient size ; the rest of the field waiting for attention should be worked superficially to prevent drying out.

Where the ridge system is adopted, and yard manure is applied in the ridges, only so many drills should be opened as can be manured and split in the same day, unless there are good reasons for departure from this rule. On free loams, the best germination may usually be obtained by drilling immediately after splitting the ridges. On land that has not worked down to a suitably fine tilth, however, it may be better to delay sowing for a week or more, during which time the middle of the drill becomes moist by the rise of moisture from below. The rise of moisture may be hastened, and the loss by evaporation from between the clods prevented, by the use of the ridge roller. The ordinary flat roll and the Cambridge roller are of less value for this purpose ; indeed, their use may be detrimental to the object in view, as, by pushing the loose top soil off the ridges and consolidating that left on the ridges, they accelerate the loss of moisture from the middle of the ridge where it is most needed. The ridge may be drawn out rather deep, preferably

with the lea plough, and left to settle and for the weed seeds to begin germinating; then, just before drilling the seed, the dry, cloddy top soil may be harrowed off with the chain harrows and the seed deposited in firm, moist soil in which it comes away quickly.

Insect Pests of Roots.—Beet and mangolds are often badly checked and sometimes thinned considerably by the leaf maggot, which makes the characteristic white blotches on the leaves where the inner tissues have been eaten away. Farmers have frequently asked whether it is possible to prevent or remedy an attack by spraying, but generally it is only when the pest has actually gained entry into the leaves that its presence is realized; and, at this stage, it is impossible to reach the maggot with a spray fluid without destroying the leaf on which it feeds. The best method of treatment, so far discovered, is to roll the crop and thereby crush the maggots. A top dressing of nitrate of soda or nitrate of lime given immediately after rolling will assist the young plants to make new growth. The possibility of rolling, however, is limited to the early stages of the crop, when the implement may pass over the plants without crushing the young tap root. Rolling and top dressing are also recommended in the treatment of attack by springtails, which cause strangle-neck in mangolds, and the flea beetle, which riddles the leaf in a manner similar to the work of the turnip flea beetle.

Hot, dry weather about the end of May generally results in the appearance of the turnip beetle and the disappearance of brairds of swedes. The beetles are attracted to the crop by its scent and it is thought that the, admittedly, useful preventive measure of soaking the seed in turpentine owes its virtue to its masking the natural odour of the crop. The smell of tar is apparently repulsive to insects and, for the prevention of attack by such pests as this, entomologists advise the application of a mixture of tar-oil and soot, one of the former per hundred of the latter. Of the remedial measures, three have been well tried and proved, *viz.*, rolling the seedlings, the application of 1 cwt. of nitrate per acre along the line of plants, and pushing a tarred board over the crop.

Crop Sequence.—One of the many reasons for the practice of crop rotation is the fact that soils are generally more productive when the kind of crop is changed from year to year than when the same species is repeated. Some crops, such as red clover, turnips and oats, are well known to be liable to disease if grown too frequently on the same ground; others,

such as wheat, barley and mangolds, are more tolerant of repetition. There is no doubt, however, that change of crop has an influence on productivity quite apart from considerations of parasitic disease.

In the course of time, farmers have found that certain crops are better than others as a preparation for the next crop. Clover, for example, is regarded as a good preparatory crop for either wheat or potatoes; but, for mangolds or swedes, clover lea is not a good predecessor. Rye is for some reason regarded as bad for the next crop. Potatoes, mangolds and cabbages affect the next crop differently, as may be seen whenever these three crops are grown in the same field and are followed by corn. Sometimes differences attributable to the kinds of root crop grown may be seen in the seeds crop two years later.

Although crops differ in the kind and amount of manurial ingredients which they remove from the soil, these differences are not now regarded as sufficient to explain their effects on the succeeding crop. Neither can past teaching concerning the different depths of rooting be accepted, since further work has shown that the cereals are in fact of deeper rooting habit than the tap-rooted crops. According to the conclusions arrived at by the Rhode Island Experiment Station workers, the effect of one crop on its successor depends on its influence on the reaction of the soil. Some crops, such as mangolds, swedes and cabbages, remove more bases than acids from the soil; others, such as maize and barley, leave the soil less acid. Crops differ also in the amount of aluminium and phosphorus which they remove per acre.

In one experiment, carried out at the station mentioned, the test crop, onions (chosen on account of its sensitiveness to soil sourness) gave the following yields after the different crops indicated: after mangolds, 72; after cabbage, 88; after swedes, 99; after maize, 296; and after red top grass, 524 bushels. In another experiment, barley grew less well after beet and carrots than after lucerne and barley. Such differences were, however, much reduced where the soil experimented upon had been suitably limed.

Calf Rearing.—There is some truth in the saying that pedigree goes in at the mouth; for the conformation of the mature animal is appreciably influenced by the liberality or otherwise of the treatment received during the growing period. This fact has been clearly demonstrated by a long series of trials carried out by the Missouri Experiment Station, in which calves of

similar ancestry were reared on three different planes of nutrition. Those fed as much as they would eat throughout their growing period made steers of heavy, broad, low-set, typical, good-beef type; those continuously fed to produce a strictly limited rate of daily gain became long-legged, narrow-chested and ungainly in appearance; while the lot fed on an intermediate scale grew into steers of intermediate type. The ultimate size of the cattle, as measured by length of frame and height at the withers, did not differ as much as one would have expected, but the underfed animals were later in attaining their maximum length and height.

Probably, it is impossible to make a calf of poor ancestry into a mature animal of good type and conformation by liberal feeding; but the photographs in the report of the above-mentioned experiment prove that calves of good breeding may grow up into animals having the appearance of bad breeding when the rearing conditions have not been satisfactory. There is also general agreement among successful breeders that the health and progress of the calf during the first six months of its life have great influence on its ultimate appearance. One careful breeder and student of cattle has made observations which have led him to the conclusion that poor rearing and too early breeding are a common cause of dairy cows going wrong under the strain of heavy milk production. The effects of a serious attack of scour in calfhood may be permanent; and a calf that has suffered a check in growth, especially such a check as is associated with leg weakness, may always be distinguished as a yearling by its lack of size and substance and by the disproportionate growth of its head and horns.

In farming practice, the recognized preventives of rearing troubles are a sufficiency of clean milk and plenty of dry bedding. Pedigree breeders generally prefer to allow their valuable calves to suck; but there are exceptions where pail feeding is preferred. In rearing for commercial purposes, however, it is necessary to limit the allowance of milk, and the problem arises as to what is the minimum amount and how it may best be supplemented with other foods. During May and June, when milk is generally more plentiful and comparatively low in price, it is possible to be more liberal with the milk allowance than it is in the winter months. At any time of the year, however, the rate at which the milk ration may be diminished depends on the progress which the calf is making in learning to eat dry foods—gruel feeding being out of date.

Calves are very fond of broken linseed cake and whole oats, which they digest more completely than do mature cattle; and these, in equal parts, make a good mixture. When water is constantly before them, calves soon learn to drink and to eat a milk substitute, so that, if necessary, milk may be discontinued entirely at about twelve weeks old. Better calves can, however, be obtained if a little milk is continued for a few weeks longer. Moreover, concentrated foods are deficient in bone-forming matter and in the vitamin which controls rate of growth; for supplying the latter requirement, therefore, the use of a little cod liver oil is advisable.

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NOTES ON MANURES FOR MAY

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Dressings for Turnips.—Turnips and swedes are grown under a number of different systems in which the manurial treatment ranges from what might be described as a mangold dressing at one end of the scale down to a light dressing of superphosphate at the other. The chief factor responsible for these differences is the climate. Drought is the great enemy of the crop; hence we find that yields are higher in the northern and western districts than in the south-east. Over the 10-year period 1915-24 the average crop of turnips and swedes was 16·7 tons per acre in Scotland, but only 11·7 tons in the eastern counties. Where conditions are favourable, manuring is on a higher scale than in less suitable areas.

In a useful summary of the manurial experiments, carried out in North Wales* at 127 centres during the last 40 years, it is shown that the average increase in crop due to phosphatic manuring was 7·4 tons, or 49 per cent. Many farmers, in the district covered by the experiments, regarded it as waste of land to drill their swedes in the absence of phosphate. Basic slags and finely ground rock phosphates were about as effective as superphosphate in these trials.

Extensive experiments, carried out by the Irish Department of Agriculture during 1901-11, give a good view of the response

* E. J. Roberts : *Welsh Journal of Agriculture*, II, 1926.

of the swede crop to manuring. The summarized results are as follows :—

Treatment per acre	Swedes : Tons per acre	
	With 10 tons dung (Mean of 238 centres)	No dung (Mean of 147 centres)
No artificials	19·0	4·9
4 cwt. superphosphate	23·8	17·5
4 cwt. superphosphate 1 cwt. sulphate of ammonia	25·0	19·0
4 cwt. superphosphate 1 cwt. sulphate of ammonia 3 cwt. kainit	26·0	22·0

Under these conditions, an addition of superphosphate to farmyard manure is all that is required, but where no dung is available a complete mixture of artificials usually does best. Similar results have been recorded in a large number of other experiments.

In the drier parts of England the risk of failure through summer drought is intensified when only artificials are used ; a light dressing of well-rotted dung is desirable under such conditions, when 3-4 cwt. of superphosphate or basic slag will be the only additional manure required. When swedes are grown for sheep, with the purpose of manuring the arable, it is often impossible to provide dung for the crop, and all cultivations are directed towards conserving moisture in the seed bed. A complete mixture of artificials, relatively rich in soluble phosphates, would meet such cases. On light and chalky soils, the potash will generally be most necessary, while a little quick-acting nitrogen will be advisable on all but the richest land.

Superphosphate is the most popular phosphatic manure for general arable purposes ; and it is often noticed that swedes, receiving their phosphate in this form, are stronger in their earliest stages than those having insoluble phosphates. On soils which are badly in need of phosphate, especially in the wetter districts, there is evidence that very finely ground rock phosphates are effective for turnips. Farmers who usually apply soluble phosphate, but are thinking of availing themselves of this relatively cheap material, would be advised to try rock phosphate on a small area first and compare the results with their ordinary treatment. Another plan which has worked well is to give about one-third of the phosphate in the form of superphosphate and the remainder as finely ground rock. High-grade basic slag may be used instead of superphosphate without loss of efficiency.

Swedes suffer from two diseases which can be controlled by suitable manurial treatment. Finger-and-toe is caused by an organism which only thrives under acid conditions, and, on soils liable to this trouble, choice should be made from such alkaline manures as basic slag, cyanamide, nitrate of soda and of lime; a dressing of chalk or lime would also be advisable. Farmyard manure made by stock receiving diseased roots should not be used for the turnip land. The turnip fly attacks the plant in its early life, and manuring can do something to hasten the crop past its vulnerable stage. Quick-acting phosphate and a supply of active nitrogen in the seed bed is a good insurance, and, if top dressing is practised, nitrates should be used. These manures, however, cannot be relied upon in times of persistent drought.

Top Dressing Sugar Beet.—The greater part of the nitrogen given to this crop is applied before drilling, and usually takes the form of an autumn dressing of farmyard manure, followed by 1 cwt. of sulphate of ammonia, included in the mixture of artificials applied, when the land is being worked down in spring. As in the case of mangolds, growers have found that a little additional quick-acting nitrogen, applied after the crop has been singled, has a beneficial effect on the yield. Nitrate of soda and nitrate of lime are the commonest fertilizers used for this purpose, as they are highly soluble and also immediately available to the plant. In 1925, an extensive series of county experiments was carried out on the growing of sugar beet in Ireland. Part of the data brought out the effect of adding a top dressing of 1 cwt. of nitrate of soda to beet which had already received a dressing of farmyard manure and complete artificials. The tests on this point were carried out at 163 centres and four varieties of beet were used in each experiment. The complete figures are published in an interesting report,* and the general trend of results is conveyed in the following table :—

Average of 163 centres. Four varieties at each centre.

Manuring	Washed beet Tons	Cwt.	Sugar Per cent.
Dung + complete artificials	10	0 ..	17·6
,, + complete artificials + 1 cwt. nitrate of soda	10	8 ..	17·5

* *Journal of the Department of Lands and Agriculture*, XXVI, No. 1, 1926.

Thus, on the average, 1 cwt. of nitrate of soda, used as a top dressing after singling, has increased the crop by about 8 cwt. of washed beet per acre without appreciably depressing the sugar content. At present prices, this is itself a remunerative increase, but the report goes on to say that owing to the value of a top-dressing for helping the young plant over critical periods in its early life, in no fewer than 190 cases it was decided to top-dress the whole experimental area, thus losing the comparison in those cases where presumably the undressed portion might have shown up very badly.

On the Continent, dressings, up to the equivalent of about 3 cwt. of nitrate of soda, are given in addition to dung, phosphate, and potash, and about half of this nitrogen is usually applied on top. It is recognized that, on rich land or on soils in high condition, somewhat smaller amounts of quick-acting nitrogen are required. Some recent results obtained in this country indicate that, on land in very good heart, top dressings may not be remunerative when dung and complete artificials have been used.

Presuming that top dressing is advisable, an application of at least 1 cwt. per acre of nitrate of soda or nitrate of lime would, under present conditions, be in place in most cases. The manure should be given about the time of singling; for, if left till later in the season—say, after the end of June—the ripening of the beets is retarded. If sulphate of ammonia is to be used for top-dressing purposes, early application is particularly desirable.

Further evidence is still wanted as to the profitableness of increasing top dressings above the usual level of 1 cwt. per acre. As the dressings are increased, the margin is admittedly smaller, and the scale of treatment must be suited more exactly to the soil and type of farming in question. Top dressings increase the leaves of the crop to a somewhat greater extent than the roots; the extra amount of organic matter thus obtained is of value, whether fed or ploughed in.

Unrotted Farmyard Manure.—Farmers are familiar with the comparatively poor action of long, strawy dung when applied immediately before potatoes or spring-sown crops. Used in this way, dung may cause an actual depression in the yield, the result often being ascribed to the straw having let the drought into the land by leaving the seed bed open and hollow. This loosening action is only one of the causes at work, for it

has been shown that, when unrotted straw is ploughed in the soil, bacteria develop so rapidly under the influence of the increased supply of organic matter that the nitrogen which they require is abstracted from the soil and built up into their own substance. The land is thus temporarily impoverished and the crop suffers. The nitrogen thus removed is not permanently lost, but will become available as the organisms die and decay. The case is similar, but still more pronounced, when straw is ploughed under.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending April 13				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½%) ..	13 15	13 15	13 10	13 12	17 7
,, ,, Lime (N. 13%) ..	..	..	..	11 12	17 10
Sulphate of ammonia :—					
Neutral (N. 20·6%)	12 6*	12 6*	12 6*	12 6*	11 11
Calcium cyanamide (N. 19%) ..	9 16*	9 16*	9 16*	9 16*	10 4
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 15	3 11
Potash salts (Pot. 30%)	4 17	..	..	4 10	3 0
,, (Pot. 20%)	3 12	3 2	3 9	3 2	3 1
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 7	3 6
Sulphate ,, (Pot. 48-51½%)	11 10	10 5	10 16	11 5	4 5
Basic slag (T.P. 40%)	..	..	..	3 10§	1 9
,, (T.P. 30%)	..	3 2§	3 1§	3 0§	2 0
,, (T.P. 28%)	..	2 11§	2 10§	..	..
,, (T.P. 26%)	..	2 7§	2 6§	..	..
,, (T.P. 24%)	..	2 2§	..	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade ¶	2 15	..	..	2 15*d*	0 11
Fine grade ‖	2 10	..	..	2 12*d*	0 11
Superphosphate (S.P. 35%) ..	3 9	..	3 12	3 10	2 0
,, (S.P. 33%) ..	..	..	3 9	..	..
,, (S.P. 30%) ..	3 2	2 15	3 5	3 3	2 1
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ½%, T.P. 60-65%)	6 0†	6 10†	6 5	5 15	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Hull prices include delivery to any station in Yorkshire, Liverpool to any station in Lancashire. London prices are for 4-ton lots delivered in the home counties.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

A certain amount of rotting, associated as it is with unavoidable losses of valuable material, is, therefore, desirable before dung can exert its best effect. The process should be carried out without unnecessary exposure of the manure to wind and weather, for such treatment only increases the losses without benefit to the quality of the resulting product. Probably, the method which is most economical, as far as the preservation of plant food is concerned, is to plough the manure into the soil in winter while it is still in a fairly long condition, this plan being most applicable to heavy soils where the winter rainfall is not excessive.

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NOTES ON FEEDING STUFFS FOR MAY

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The Origin, Composition, Nutritive Value and Uses of Dried Sugar-Beet Pulp.—In the production of cane sugar from sugar beet, the beets are sliced, and the sugar in the slices is removed by a process of diffusion with water. The diffusers consist of large metal cylinders connected together in series, each series, say, of twelve diffusers being known as a battery. The action of the battery is to produce a diffusion juice of high sugar content, and to enable the slices to be almost completely exhausted of their sugar. As each batch of slices in the diffuser becomes exhausted, it is discharged and conveyed to a pulp press, where it is pressed to remove as much water as possible. The press pulp so obtained contains 85 to 90 per cent. of water and every 100 tons of beets entering the factory yield approximately 40 to 50 tons of press pulp. This press pulp is then passed through a drying chamber and yields approximately six tons of dried pulp.

The development of sugar-beet factories in this country has given rise to the production of considerable quantities of dried sugar-beet pulp, and, since this product is a distinctly useful feeding stuff, it is desirable that British farmers should use this home-produced material for feeding to their stock. At the present time, considerable quantities of this material are being exported to America and elsewhere, so that it is evident that the British farmer is not making as full use of this material as he might. This disinclination on the part of the British farmer to use dried sugar-beet pulp may possibly be due to lack of knowledge of the feeding value of this

material or to lack of knowledge of the methods of feeding it. In the following paragraphs an attempt will be made to present such facts as are known on these two points.

Composition of Dried Sugar-Beet Pulp.—Dried sugar-beet pulp is rich in carbohydrates and low in proteins and oil, and when damped approximates to roots in character and utility. Analyses of dried sugar-beet pulp produced in Great Britain show that considerable variations in composition occur, but the following analysis may be taken as indicating the average composition :—

Water	9·5	Carbohydrates	60·5
Proteins	8·6	Fibre	16·2
Oil	0·7	Ash	4·5

The sugar content of the dried pulp varies generally from 1 to 6 per cent., the amount present varying with the efficiency of control of the diffusers at the factory. To indicate the variability of composition, the following fluctuations, in composition—from figures obtained from one group of factories—will suffice: Water, 9 to 15 per cent.; protein, 7·5 to 10 per cent.; carbohydrates, 56 to 58 per cent.; ash, 3·4 to 4·8 per cent.; fat, 0·5 to 0·8 per cent.; fibre, 16·8 to 20·1 per cent.

Digestibility.—The dried sugar-beet pulp is a digestible material, as the following figures show. The protein is 51 per cent. digestible, the fat is 50 per cent., the carbohydrates 86 per cent., and the fibre 72 per cent. digestible. 100 lb. of dried sugar-beet pulp of average composition will therefore contain 4·4 lb. of digestible protein, 0·4 lb. of digestible fat, and 63·7 lb. of digestible carbohydrates and fibre, and will have a starch equivalent of 59·8 On the basis of these figures, dried sugar-beet pulp compares very favourably with other feeding stuffs at its present market price.

Feeding Value of Dried Sugar-Beet Pulp.—As the analysis indicates, dried sugar-beet pulp is a starchy material, and should therefore be fed in conjunction with foods rich in protein and oil. It is important to realize that, if wetted before feeding, dried sugar-beet pulp should be regarded as a root substitute and be fed accordingly, whereas if fed dry it should be regarded as a concentrate. Owing to its capacity for absorbing water and swelling in the process, less danger arises from careless feeding in the case of the wetted pulp than in the case of the dry pulp. Dried sugar-beet pulp when fed wet is suitable for all classes of stock and has been fed successfully to cattle, milch cows, horses, sheep, and pigs.

If fed wet, the pulp requires soaking for about 12 hours before feeding. In an experiment carried out at Little Snoring, in Norfolk, it was found that 14 lb. of dried pulp required about 28 lb. of water, and that, for fattening bullocks, 14 lb. of dried pulp were equivalent in feeding value to 1 cwt. of roots. At Cirencester and in Nottingham extensive feeding experiments have proved the value of dried sugar-beet pulp as a food for dairy cows, and the material was proved to be quite palatable, the cows readily consuming the dried pulp. If fed in the dry

Farm Values.—The prices, in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	9 18
Maize	81	6·8	7 12
Decorticated ground nut cake	73	41·0	10 15
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·28 shillings, and per unit protein equivalent, 1·42 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	8 18
Oats	60	7·6	7 8
Barley	71	6·2	8 11
Potatoes	18	0·6	2 2
Swedes	7	0·7	0 17
Mangolds	7	0·4	0 16
Beans	66	20·0	8 19
Good meadow hay	31	4·6	3 17
Good oat straw	17	0·9	2 0
Good clover hay	32	7·0	4 3
Vetch and oat silage	13	1·6	1 12
Barley straw	19	0·7	2 4
Wheat straw	11	0·1	1 5
Bean straw	19	1·7	2 6

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	12 7	0 14	11 13	72	3 3	1·74	9·6
Barley, British feeding	—	—	10 0	0 11	9 9	71	2 8	1·43	6·2
„ Canadian No. 3 Western	36 0	400	10 2†	0 11	9 11	71	2 8	1·43	6·2
„ Argentine	35 0	„	9 17	0 11	9 6	71	2 7	1·38	6·2
„ Persian	30 3	„	8 10	0 11	7 19	71	2 3	1·20	6·2
„ Russian	36 3	„	10 3	0 11	9 12	71	2 8	1·43	6·2
Oats, English, white	—	—	9 7	0 12	8 15	60	2 11	1·56	7·6
„ „ black and grey	—	—	9 0	0 12	8 8	60	2 10	1·52	7·6
„ Scotch white	—	—	10 0	0 12	9 8	60	3 2	1·70	7·6
„ Irish black	—	—	8 10	0 12	7 18	60	2 8	1·43	7·6
„ American	21 6	320	7 10‖	0 12	6 18	60	2 4	1·25	7·6
„ Argentine	24 3	„	8 10	0 12	7 18	60	2 8	1·43	7·6
„ Chilian	22 6	„	7 17	0 12	7 5	60	2 5	1·9	7·6
Maize, Argentine	32 6	480	7 12	0 11	7 1	81	1 9	0·94	6·8
Beans, English winter	—	—	10 10	1 10	9 0	66	2 9	1·47	20
Peas, English blue	—	—	17 0*	1 6	15 14	69	4 7	2·45	18
„ „ dun	—	—	12 10	1 6	11 4	69	3 3	1·74	18
Dari, Bombay	—	—	11 0	0 14	10 6	74	2 9	1·47	7·2
Millers' offals—									
Bran, British	—	—	7 17	1 5	6 12	42	3 2	1·70	10
„ broad	—	—	8 17	1 5	7 12	42	3 7	1·92	10
Middlings, fine, imported	—	—	10 5	1 0	9 5	69	2 8	1·43	12
„ coarse, British	—	—	8 5	1 0	7 5	58	2 6	1·34	11
Pollards, imported	—	—	7 10	1 5	6 5	60	2 1	1·12	11
Meal, barley	—	—	10 15	0 11	10 4	71	2 10	1·52	6·2
„ maize	—	—	9 10	0 11	8 19	81	2 3	1·20	6·8
„ „ germ	—	—	8 15	0 18	7 17	85	1 10	0·98	10
„ „ gluten feed	—	—	8 15	1 5	7 10	76	2 0	1·07	19
„ locust bean	—	—	8 10	0 9	8 1	71	2 3	1·20	3·6
„ bean	—	—	12 10	1 10	11 0	66	3 4	1·78	20
„ fish	—	—	22 0	3 18	18 2	53	6 10	3·66	48
Maize, cooked flaked	—	—	10 5	0 11	9 14	85	2 3	1·20	8·6
Linseed	—	—	17 10	1 9	16 1	119	2 8	1·43	19
„ cake, English 12% oil	—	—	12 3	1 15	10 8	74	2 10	1·52	25
„ „ „ 10% „	—	—	11 15	1 15	10 0	74	2 8	1·43	25
„ „ „ 9% „	—	—	11 10	1 15	9 15	74	2 8	1·43	25
Soya bean cake 6% „	—	—	11 5*	2 9	8 16	69	2 7	1·38	36
Cottonseedcake, English, 5½%„	—	—	6 15	1 12	5 3	42	2 6	1·34	17
„ „ Egyptian, 5½% „	—	—	6 10	1 12	4 18	42	2 4	1·25	17
Decorticated cottonseed cake, 8% oil	—	—	10 0	2 9	7 11	74	2 0	1·07	35
„ „ meal, 7% oil	—	—	10 5	2 9	7 16	74	2 1	1·12	35
Coconut cake, 6% oil	—	—	9 0	1 9	7 11	79	1 11	1·03	16
Ground-nut cake, 6% oil	—	—	8 2	1 13	6 9	57	2 3	1·20	27
Decorticated ground-nut cake, 7% oil	—	—	10 15	2 11	8 4	73	2 3	1·20	41
Palm kernel cake, 6% oil	—	—	7 17	1 1	6 16	75	1 10	0·98	17
„ „ „ meal, 6% oil	—	—	9 15*	1 1	8 14	75	2 4	1·25	17
„ „ meal 2% oil	—	—	8 5*	1 2	7 3	71	2 0	1·07	17
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1·20	2·7
Brewers' grains, Dried ale	—	—	7 15	1 2	6 13	49	2 9	1·47	13
„ „ „ porter	—	—	7 5	1 2	6 3	49	2 6	1·34	13
„ „ Wet ale	—	—	1 7	0 8	0 19	15	1 3	0·67	4·8
„ „ „ porter	—	—	1 2	0 8	0 14	15	0 11	0·49	4·8
Malt culms	—	—	6 0	1 12	4 8	43	2 1	1·12	16

Prices at London except where otherwise stated.

* At Hull. † At Liverpool. ‖ At Bristol.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is £1 1s. per ton. The food value per ton is therefore £8 19s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 11s. 8d. P_2O_5, 3s. 8d.; K_2O, 3s. 0d.

state, it is important to accustom the animals to this material by introducing it gradually into the ration.

Quantities to Feed.—The following figures may prove useful as a guide to those using dried sugar-beet pulp :—

	Per head per day (maximum quantities)
Horses	5 lb.
Cows	7 lb.
Fattening cattle	10 to 14 lb.
Calves	2 to 3 lb.
Pigs	1 to 3 lb.

The writer hopes that all farmers who have used this material will communicate with him, giving the results of their practical experience with it and details of their methods of feeding.

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MISCELLANEOUS NOTES

Conditions in the Hop-fields*

THE report of the Medical Officer of Health for South-West Kent (a most important hop-growing district) on the health of the hop-pickers in 1926 gives an interesting account of work by official and voluntary agencies on behalf of the hop-pickers. Reference is made to the increasing attention given to the various problems raised by the annual migration of pickers and to the closer co-operation between the various interests concerned which has been effected during the last three years by the Mid-Kent Hop-pickers Committee, a representative body, of which Mr. J. A. Spender is chairman. This Committee has concentrated, in the first place, on improvement of transport conditions, and appreciation is expressed of the arrangements made last year by the Southern Railway, who conveyed more than 25,000 pickers to stations in South-West Kent.

The scale on which assistance is given to the pickers by the voluntary dispensaries is indicated by the fact that, in addition to help given by local practitioners, two women doctors, 31 qualified nurses, and 50 V.A.D.s were engaged on this work last year, when over 7,000 patients (who made nearly 14,000 attendances) were treated. There are nine main dispensary centres, but many of these have branches, and one at Marden (organized by Mrs. Spender) is now

* "Living Conditions of Hop-pickers in Kent": see this JOURNAL, June, 1925, p. 219. "Hop-pickers' Accommodation," model by-laws drawn up by the Ministry of Health: see this JOURNAL, August, 1926, p. 468.

provided with excellent buildings, comprising hospital wards, administrative quarters and an isolation hut. Patients suffering from infectious diseases or other serious ailments are dealt with at the neighbouring hospitals and infirmaries.

A much needed development was the appointment, last year, of some additional temporary sanitary inspectors for the hop-picking season. From these officers' reports it appears that a number of new huts were erected in 1926 and that sundry improvements were made in existing structures. It is pointed out that, in some of these new huts, excellent results have been achieved at moderate cost.

There appears to be general agreement that living conditions for the hop-pickers have been substantially improved as far as supplies of drinking water are concerned, and that a noticeable effort has been made to improve accommodation, particularly in regard to cooking and sanitary arrangements. In both these directions, however, much remains to be done, and it is to be hoped that the beginning made last year may be the foundation of a general advance in 1927.

* * * * * *

The Ministry's Publications

THE following figures relative to the distribution of the Ministry's publications during the last two financial years may be of interest. The number of leaflets distributed *free* during 1926-27 was 36,654 as compared with 55,692 during the year 1925-26, a decrease of 19,038, that is 34 per cent. The number of leaflets *sold* during the year was 60,968 as compared with 60,511 during the previous year, an increase of 457. Of the Sectional Volumes of bound leaflets on connected subjects 14,569 were sold in 1926-27 as compared with 14,029 during the previous year, an increase of 540 copies.

The Ministry's "Miscellaneous Publications "on subjects of practical interest to farmers and horticulturists, including the new series of Research Monographs, show an encouraging increase. The total number of these publications distributed during 1926-27 was 17,255 copies as compared with 15,316 during the previous year, *i.e.*, an increase of nearly 13 per cent.

Certain of these publications are evidently highly appreciated, judging from the numbers sold and the steadily increasing demand. For example, *British Breeds of Live Stock*, of which a fifth edition has now been called for, has had a sale of over 13,000 copies; Prof. T. B. Wood's *Rations for Live Stock*, also in its fifth edition, of 18,850 copies; and *Edible and Poisonous Fungi*, of over 5,000 copies.

THE Director of the Rothamsted Experimental Station, Sir John Russell, has renewed this year the opportunity for farmers' and farm workers' associations and clubs, chambers of agriculture and horticulture, students' societies and other bodies interested in agriculture and market gardening to inspect, during the summer months, the experimental plots at the Station, where Mr. H. V. Garner, M.A., will act as guide and demonstrator. Among items of interest to be seen are experiments on the manuring of arable crops, especially sugar beet, potatoes, mangolds, barley, oats, wheat; manuring of meadow hay; effect of modern slags and mineral phosphates on grazing land and hay land; inoculation of lucerne; crop diseases and pests; demonstrations of good types of tillages. It is desirable that arrangements for visits should be made beforehand, and that ample notice should be given to prevent possible clashing of dates, although no farmer need refrain from visiting because he has been unable to write fixing a date. All communications on the subject of visits should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden, Herts.

Demonstrations at Rothamsted

* * * * * *

MR. HUGH C. SAMPSON, C.I.E., B.Sc., formerly Director of Agriculture, Madras, has been appointed Economic Botanist at the Royal Botanic Gardens, Kew. This appointment has been made in connexion with the grant of £4,000 for five years which has been received from the Empire Marketing Board through the Ministry of Agriculture and Fisheries.

New Appointment at Kew

The grant will be devoted partly to the employment of the economic botanist, who will be available either to visit the Dominions and Colonies from time to time or to set free a superior officer of the Kew staff to undertake oversea missions, and partly to sending botanical collectors to various parts of the world to study and bring home plants of economic importance for cultivation at Kew and distribution to the Dominions and Colonies.

The close liaison which exists between Kew and the agricultural and botanical departments of the world has proved of great benefit to the Dominions and Colonies in the introduction of new staples and the development of the natural vegetable resources of the Empire. With the progressive opening up of new territories and the continual expansion of agricultural

enterprise in the Dominions and Colonies, the need has arisen for a closer co-operation and a more direct service, and these the grant is designed to afford.

* * * * * *

Agricultural Research

THE Ministry is prepared to receive, not later than the 15th of this month (May) applications for grants in aid of scientific investigations bearing on agriculture, to be carried out in England and Wales during the academic year commencing October 1, 1927. The conditions on which these grants are offered are set out in the prescribed form of application (A. 53/T.G.), of which copies may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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The Agricultural Index Number

THE general level of the prices of agricultural produce during March was 43 per cent. higher than in March of the base years 1911-13, or two points lower than in February, and six points below the level of a year ago, when a fall of four points was registered between February and March. Prices showed little movement on the whole, but, as is customary at this period of the year, eggs were considerably reduced in price. Milk and potatoes were also cheaper, while fat sheep were dearer.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

	Percentage Increase compared with the Average of the corresponding month in 1911–13					
Month	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	—
May	69	54	57	57	50	—
June	64	49	56	53	48	—
July	67	50	53	49	48	—
August..	68	52	57	54	49	—
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.—Wheat, barley and oats all showed a decline of 2d. per cwt. on the month, and the index figures for wheat and oats were each a few points lower at 57 and 14 per cent. above

pre-war, respectively, the former being at nearly the same level as a year earlier, while oats were about 10 per cent. cheaper. The index figure for barley was, however, one point higher on the month, at 38 per cent. increase on 1911-13, owing to a relatively greater decline in prices in the corresponding period of the base years. Wheat averaged 11s. 8d., barley 10s. 11d., and oats 8s. 1d. per cwt.

Live Stock.—The prices of fat cattle showed a further reduction of about 6d. per live cwt. in March, and at only 26 per cent. dearer than pre-war were at the lowest level reached in recent years. Dairy cows and store cattle were also comparatively cheap at 25 and 27 per cent. above pre-war. Fat sheep and pigs, however, were both somewhat dearer than in February, the former having appreciated about ½d. per lb. estimated dressed carcass weight, and the index figure is one point higher at 45 per cent. increase on 1911-13. The index numbers for both pork and bacon pigs are well maintained at recent levels, but these are lower than in March, 1926. Store pigs, however, met with a good demand during the month under review, and at 116 per cent. above pre-war are fully as dear as a year ago.

Dairy and Poultry Produce.—There was a considerable fall in the price of eggs during the month under review, the average quotation being 1s. 2d. per dozen as compared with 1s. 10¼d. in February, and the index number fell sharply by 23 points to 39 per cent. above the level of March, 1911-13, a position which is very similar to that of the two previous years. Milk also was cheaper, principally in the Manchester area, and the index figure is 6 points lower on the month and 16 points below the level of March, 1926. Butter and cheese remained practically unaltered in price, and the relative index figures showed no movement from those recorded in February. Prices of fowls were rather higher on the month, but ducks were unchanged as compared with February, while in the base years prices advanced in March.

Other Commodities.—Potatoes were somewhat cheaper than in February, and, as prices increased in March in the base years, there was a reduction of 9 points in the index figure, bringing the figure to 85 per cent. above pre-war as compared with 31 per cent. in March, 1926. Vegetables generally were about 37 per cent. dearer than pre-war, or 4 points below the level in February. There was no change in hay prices, and these were practically identical with those of March of the base years. Wool was a little dearer, but, as there was a corres-

ponding increase in the base period, the index number was only slightly altered to 33 per cent. above the level in 1911-13.

Index numbers of different commodities during recent months and in March, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926		1927		
	Mar.	Mar.	Dec.	Jan.	Feb.	Mar.
Wheat	79	55	61	61	60	57
Barley	45	14	31	35	37	38
Oats	38	25	17	20	16	14
Fat cattle	51	43	28	33	30	26
Fat sheep	97	52	44	57	44	45
Bacon pigs	67	85	63	70	63	63
Pork pigs	66	89	72	82	75	76
Dairy cows	48	37	30	28	26	25
Store cattle	43	31	21	29	30	27
Store sheep	104	61	41	55	48	41
Store pigs	47	115	115	135	125	116
Eggs	49	41	46	46	62	39
Poultry	57	50	49	38	39	34
Milk	82	72	65	65	62	56
Butter	58	46	40	37	40	40
Cheese	57	77	28	38	36	36
Potatoes	138	31	110	95	94	85
Hay	— 1*	6	2	— 1*	— 2*	—
Wool	105	39	29	32	32	33

* Decrease.

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Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on March 22, at 7 Whitehall Place, S.W. 1, the chairman, Lord Kenyon, presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying out the Committees' decisions.

Devonshire.—An Order fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers to come into operation on March 26, when the existing rates are due to expire, and to continue in force until March 25, 1928. The rates in question are, in the case of male workers of 21 years of age and over, 32s. 6d. per week of 52 hours from May 30 to September 19 (instead of from June 16 to September 30 as at present) and 50 hours during the remainder of the year, with overtime at 8½d. per hour on week-days and 10d. per hour on Sundays, except during the hay and corn harvests, when the overtime rate is 10d. per hour. The minimum rate for female workers of 20 years of age and over is 5d. per hour for all time worked.

Somerset.—An Order fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers

to come into operation on April 1, when the existing rates are due to expire, and to continue in force until September 30. The minimum rates in question are, in the case of male workers of 21 years of age and over, 32s. per week of 52 hours (instead of 50 hours as at present), with overtime at 9d. per hour, and, in the case of female workers of 21 years of age and over, 6d. per hour for all time worked.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending April 15, legal proceedings were taken against 17 employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board for workers in agriculture. Particulars of the cases are as follows :—

County	Court	Fines £	s.	d.	Costs £	s.	d.	Arrears of wages £	s.	d.	Workers concerned
Hereford ..	Bromyard ..	3	10	0				65	0	0	3
Monmouth	Chepstow .	0	10	0				35	7	1	3
Chester ..	Chester ..							3	5	0	1
,, ..	,, ..										2
Yorks, W.R.	Wakefield .							29	0	0	2
Cambs. ..	Wisbech ..	4	0	0	1	5	6	33	0	0	2
Norfolk ..	Terrington .	4	0	0	1	0	0	28	6	3	4
Salop ..	Shifnal ..				0	10	0	4	10	0	1
Somerset	Wincanton ..	1	0	0	0	7	6	7	9	7	1
,, ..	Long Ashton	1	0	0				15	0	0	1
,, ..	Somerset ..	5	0	0	0	5	0	15	0	0	1
,, ..	Wells ..				2	2	0	13	2	3	1
Devon ..	Lifton ..	0	10	0	0	17	0				1
Salop ..	Ludlow ..				1	2	6	11	0	0	1
,, ..	,, ..				1	2	6	5	0	0	1
,, ..	,, ..				0	15	0	20	0	0	1
,, ..	,, ..				1	2	6	14	0	0	1

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Foot-and-Mouth Disease.—Since the April JOURNAL was issued there has been a fresh centre of disease discovered at Ellel, Lancaster. Two outbreaks occurred on adjoining farms in that parish on April 5 and 6 respectively. No other outbreaks have been confirmed.

Twenty-three outbreaks have been confirmed in all since January 1 last, involving nine counties and the slaughter of 1,082 cattle, 738 sheep and 352 pigs.

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Leaflets Issued by the Ministry.—Since the date of the list given in the April (1927) number of this JOURNAL, p. 92, the following leaflets have been issued :—

New :—
- No. 165. Rhododendron Bug.
- No. 172. Greenhouse White Fly.

Rewritten :—
- No. 224. Narcissus Cultivation.

Revised :—
- No. 400. List of the Ministry's Publications.

NOTICES OF BOOKS

The Rural Industries of England and Wales. Vol. I. Timber and Underwood Industries and Some Village Workshops. Vol. II. Osier-growing and Basketry and some Rural Factories. By Helen E. FitzRandolph and M. Doriel Hay. (Oxford: The Clarendon Press. Price 5s. net each.)

These are the first two volumes of a four-volume survey of Rural Industries, made on behalf of the Agricultural Economics Research Institute at Oxford. Even without the remaining volumes, the work already published constitutes an outstanding landmark in the history of the subject. It is full of interesting facts about the industries it covers and is the first fairly complete survey of its kind.

In 1919, so a preface by Mr. C. S. Orwin, Director of the Institute, tells us, the Institute set the inquiry on foot at the suggestion of the Development Commissioners. It began with an investigation into rural industries in the neighbourhood of Oxford, but was extended the next year, with the authority of the Development Commission and the Ministry of Agriculture, to an inquiry into the principal rural industries in England and Wales. The compilers were to consider—

(1) The existing rural industries and the causes of their establishment in particular localities, such as easy access to local supplies of raw material and labour and local markets for the finished product.

(2) The various types of organization in these industries, such as small factories and workshops or individual production; organizations for the purchase of raw materials or the sale of finished products; educational facilities and the possibility of technical instruction.

(3) The economic and social effect of rural industries; the conditions of labour attendant on them; the connexion between rural industries and agricultural employment; and how far such industries tend to depress or ameliorate the lot of the agricultural workers.

(4) The prospects of development of such industries and of the introduction of new industries, or of the resuscitation of former industries now dead or in a state of suspended animation. In this last connexion, the existence of competition, both urban and foreign, was to be borne in mind and consideration given to the conditions under which rural industries can compete with urban production.

This shows the very wide terms of the inquiry and the considerable problem which the investigators were called upon to examine. They have not in these volumes followed the terms too meticulously and the survey seems, consequently, to fall into a better channel; although, doubtless, all the headings will be dealt with as it becomes expedient or useful to do so.

Among the larger industries dealt with in Volume I are furniture-making, turnery, coopering and clogging; and, among the smaller, the making of all kinds of wicker and wooden baskets, fencing, hurdles, brooms, barrel-hoops, hay-rakes, and the making of charcoal. The processes and tools used, and the organizations employed in the various districts, are thoroughly discussed, with results which cannot fail to be of mutual advantage to those engaged in the industries. The consideration of village workshops covers those of the wheelwright, blacksmith, saddler, as well as the rural ropewalk, and village net and cord-making. This will also be found to be an interesting and useful section, with information as to several branches of work that has never been previously collected.

The second volume deals mainly with osier-growing and basketry. It sets out the geographical distribution of the industries, that is, according to the osier and willow districts, discusses conditions in the principal of them, as well as their business organizations, labour supply, cultivation and marketing. There is, of course, quite a large demand for agricultural and other baskets, extending from those in use by potato diggers to those required by fanciers for the transport of pigeons, rabbits, and so on. Then there are the various kinds of skeps required as domestic baskets, fish baskets, broccoli crates and chip baskets. The fact that all these are being made in competition with supplies from Belgium, Holland, and elsewhere shows that the industry is, at any rate, able to maintain itself, and deserves the support and encouragement of home buyers. Some of the firms in the industry which were not too soundly established have already been wiped out by foreign competition, so that the struggle for existence is a very real one. The standard of British work must at least be maintained where the foreigner's is being improved. Covent Garden requires the best baskets; we trust that the home industry will continue to produce them. We know that labour and materials are, very often, cheaper on the Continent, but our industries should be able to secure an advantage by proximity to the country markets and by the elimination of middlemen. The problem is by no means easy, though it may, conceivably, be made less difficult for some growers and makers by the ready support of our own people.

Bitter Pit in Apples: A Review of the Problem.—Being Special Report No. 28 of the Food Investigation Board of the Department of Scientific and Industrial Research. (London: H.M. Stationery Office. Price 1s. net.)

The appearance of apples affected with bitter pit is generally familiar to those engaged in growing and marketing apples. The flesh of the apples shows small brown spots, dry and spongy, which are usually most numerous just under the skin. Bitter pit is known in America, Australia and Europe, both as an orchard and storage trouble: it seems to cause most trouble in the warmer countries.

In this report, the present position of our knowledge is critically discussed. So far, no organism has been found and, in consequence, many theories have been advanced to explain the causes of bitter pit, but, as the report points out, in no case has direct experimental verification been obtained, whilst, on theoretical grounds, most of the theories are open to grave objection.

It would appear that severe pruning on the one hand, and heavy water supply towards the end of the season on the other, are circumstances predisposing to bitter pit. It has been found to develop in storage to a much greater extent in fruit which has been gathered in a relatively immature condition than in fruit allowed to ripen thoroughly on the tree. The report has brought together our results of research work on bitter pit and revealed the lack of knowledge of the whole matter.

Temperature Conditions in Regard to the Cold Storage of Fruit.—Special Reports of the Food Investigation Board of the Department of Scientific and Industrial Research. No. 29: *Temperature Conditions in Small Cold Storage Chambers Containing Fruit.* 1s. net. No. 27: *Temperature Conditions in Refrigerated Holds Carrying Apples.* 1s. 6d. net. (London: H.M. Stationery Office.)

In the storage of fruits, the limits of temperature within which good results can be obtained are comparatively narrow. If the temperature is too low, there is a liability to internal breakdown and even killing of the

fruits: whilst, if too high, the fruit matures too quickly. Uniformity of the correct temperature, throughout the whole store at all times, is the ideal condition at which cold storage aims. That this counsel of perfection is difficult to secure in practice is shown in the two above-mentioned reports.

Report No. 29 gives a detailed account of the temperature distribution in five cold storage chambers containing fruit, situated in different parts of England. The temperature of parts of the fruits differed as a rule by at least two degrees, and sometimes by as much as five. Surprising to relate, forced air circulation increased these inequalities of temperature: for it was found that the air failed to penetrate the main bulk of fruit, its flow being short circuited. Observations, in these different chambers, agree in indicating that the actual cooling of the stack of fruit depends, to a great extent, more upon convexion currents operating in the quiescent night period than upon the forced air movement. The conclusion is, therefore, drawn that the refrigeration should be applied to the top of the stack, which should be so arranged as to facilitate the movement of air currents by convexion.

Report No. 27 gives an account of the temperature movements in the refrigerated hold of three vessels bringing Australian apples to this country. In every case, it was found that a considerable period of the voyage (from 10 to 20 days) was occupied in cooling down the warm fruit to the temperature of the carriage. No uniform temperature all over the hold was secured whilst the fruit was being cooled down. In the lower hold, the warmest and coolest parts of the cargo frequently differed in temperature by 15° and rarely by less than 10°. Forced air circulation again failed to bring about either more rapid cooling or a more uniform temperature. The observations showed the desirability of providing vertical air channels in the cargo, and the application of refrigeration from the top.

The Feeding of Domestic Animals. By Professor Nils Hansson. Füttering der Haustiere: Ihre theoretischen Grundlagen und ihre wirtschaftliche Durchführung, von Nils Hansson. Übersetzt von Franz von Meissner; überarbeitet und mit einem Vorwort versehen von Professor Dr. Georg Weigner. (Dresden: Verlagsbuchhandlung Theodor Steinkopff. Price: paper covers, 8 marks; bound, 10 marks.)

More than forty years ago, Fjord, working at Copenhagen, commenced an investigation into the values of the common farm feeding stuffs for milk production. From 1898 onwards, these early experiments have been continued and expanded by the famous Swedish scientist, Professor Nils Hansson, at his Institute in Stockholm. Data have been accumulated in hundreds of trials with groups of dairy cows, and from these results has been elaborated the Scandinavian food unit system, which, at the present time, is the accepted basis of feeding in Sweden, Denmark, Norway, Finland, and other countries in northern Europe.

Thus, at a time when Kellner, in Germany, was carrying out the series of investigations on *fattening oxen*, which led, ultimately, to the formulation of his well-known system of starch values, Hansson, in Sweden, was working from an entirely different standpoint, basing his system of food values on results obtained with *milking cows*. The work of Kellner has influenced profoundly the development of nutritional science in this country; whereas Hansson's results appear to have received but tardy recognition, due, in large measure, to the fact that so little of his published work has been translated from the original Swedish. The translation of the present work into German

was the result of a widespread desire among scientists in Germany to know more about a system of feeding which has proved so successful in dairy countries like Sweden and Denmark. It is to be hoped that the appearance of an English edition will not be long delayed.

The Feeding of Domestic Animals, to give the volume an English title, is divided into three main sections. The first of these opens with an account of the composition and digestibility of feeding stuffs and concludes with a discussion of the merits of the different methods of assessing the productive values of feeding stuffs. Of particular interest to English readers is the comparative account of the Hansson food unit, the Kellner starch value and the Armsby net energy value. The nutritive properties of the individual feeding stuffs are dealt with in the second section, while the concluding section is devoted to a thorough consideration of the scientific principles underlying the nutrition of calves and other young stock, of dairy cows and fattening oxen, of sheep, pigs, goats, and horses. Mention should be made of the tables at the end of the book. Table I shows the average composition and digestibility of a very large number of feeding stuffs, together with their productive values in terms of food units, starch values and, this representing a novel feature, of milk-producing values also. In Table II, the nutritive requirements of all classes of farm stock are recorded in great detail.

Professor Hansson's textbook should be read with interest and profit by all who are concerned with the feeding of farm animals in accordance with accepted scientific principles. An English translation, however, is necessary, if the work is to have more than a limited scope of usefulness in this country.

Studies on the Origin of Cultivated Plants. By N. Vavilov. (Bulletin of Applied Botany and Plant Breeding, xvi, No. 2. Leningrad, 1926.)

The considerable amount of research on the time and place of origin of the various cereals, and other agricultural crops, carried out during the past decade by the Institute of Applied Botany and Plant Cultures is summarized in a very interesting paper by Prof. Vavilov, who has been personally responsible for much of the work. It is impossible to review this work adequately in a small space and it must suffice to say that by combining methods of morphological study, breeding, geographical distribution, and archæological research the earlier conclusions of De Candolle, Darwin and others, have been very much modified. Five principal centres of origin for the most important field and garden crops are recognized as follows: South-Western Asia, South-Eastern Asia, the Mediterranean Basin, Abyssinia and adjacent regions, and Mexico and Peru. Useful maps and bibliographical references are included in the work.

The Farmers' Guide to Ownership of Land. (London: Central Landowners' Association. Price 3s. net.)

In the past, the ownership of agricultural land was vested in comparatively few hands, and farms were most commonly rented from the owners of broad acres and long rent rolls. The stimulus of high prices between 1916 and 1919, however, encouraged farmers to buy their holdings; while, in many cases, they were practically forced to do so, owing to the owners putting their estates on the market. The new owners have many fresh matters to consider. They have to keep before them the obligations and liabilities of ownership; questions relating to boundaries, fences and gates can no longer be referred to the agent; repairs to buildings will force themselves upon notice; tithe rentcharge, income tax and land tax assume a new aspect; the

development of building land and relationships with local authorities may crop up; and even death duties need to be faced.

The Central Landowners' Association is greatly interested in the advent of the new landowners, and has to deal with many applications for advice. The Association is always ready to assist individual members and owners, of all classes, in any difficulties and uncertainties which may face them. In order to provide written guidance on many of the questions which may present trouble to occupying owners, Mr. R. Strachan Gardiner, the Secretary of the Association, has recently issued a volume of 84 pages, under the above title. In the preface to this useful little work, Sir G. L. Courthope, the chairman of the C.L.A. Executive Committee, states that it gives everything that the farmer-owner ought to know of the law affecting his farm, and the burdens which he has to bear in the shape of rates, taxes, and tithe.

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Rents and Prices of Agricultural Land in South Wales, 1915-25. *A. W. Ashby* and *J. Pryse Howell.* (Welsh Jour. Agric., III (Jan., 1927), pp. 5-23.) [333.5 (42) ; 338.5.]

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NOTES FOR THE MONTH

Empire Marketing Board Displays

In connexion with the Empire Shopping Weeks that are being arranged in a number of provincial towns during the present year, the Ministry is endeavouring through appropriate channels to bring the claims of home produce prominently before local distributors and consumers. In the larger cities, a special exhibition of Empire, including home, produce will form the central feature of the arrangements.

The first of this series was held at Belfast from May 23 to 28. The Northern Ireland Government, the Municipal Authorities, and the various trading organizations all took up the project with enthusiasm; in the result, a standard was set which other cities will find it difficult to surpass. The streets were gay with flags and streamers, various social functions were organized, and the shopkeepers vied with each other in presenting Empire produce (both from home and overseas) to the best advantage. The Ulster Hall was utilized for a special exhibition of Empire goods on lines familiar to those who recently visited the British Industries Fair or the Ideal Home Exhibition.

The Ministry, as the Department responsible for the organization of the Great Britain section, secured the co-operation of the National Farmers' Union, the Food Manufacturers' Federation, the National Food Canning Council, the British Glasshouse Producing Marketing Association, the Western Curers' Association, and the National Association of Cyder Makers. On this occasion, instead of dividing the available space between associations, an attempt was made to stage a composite display representing British agriculture as a whole, and the result fully justified the experiment. The stand was both attractive and dignified, and afforded conclusive evidence of the variety and excellence of the foodstuffs derived from our native soil. In the centre

was an imposing pyramid of fruit products—canned and bottled fruits, preserves and cyder. In another part of the stand, tinned vegetables were shown, also processed and packed cereal foods, such as porridge oats, shredded wheat, etc. The live stock branch of the industry was represented by an excellent selection of bacon, hams and lard, together with meats of all kinds in tins and jars. Dairy produce received adequate recognition ; cheeses of all kinds and several makes of crustless cheese in cartons were shown, as well as condensed and dried milk. Finally, there was a most attractive show of glasshouse produce, including tomatoes, cucumbers and mushrooms.

It was an agreeable surprise to local consumers to see the variety of products in tins, bottles, etc., now being produced in England, and it is to be hoped that home producers and manufacturers will follow up the advantage of the sentiment that has undoubtedly been stimulated in favour of their goods.

* * * * * *

The Cambridge Agricultural Organizers' Conference

THIS Conference, the third of its series, was held at Cambridge just before Easter. A report of the meeting is printed elsewhere in this issue of the JOURNAL (p. 201), and the addresses delivered at the Conference will shortly be available in printed form as one of the Miscellaneous Publications of the Ministry. The special value of these Conferences is that they bring into direct touch with research workers those who are responsible for agricultural education in the counties and upon whom falls the duty of giving practical advice to farmers. There is not a little to learn upon both sides. The abstractions of research are both necessary and, in a sense, an impediment ; it is only by a process of abstraction that a scientific problem can be reduced to its elements and resolved ; but this very process removes the researcher from the conditions of everyday life. Further, although researchers are not physically remote from human affairs, but live and move and have their being in our midst, it is very salutary for them from time to time to be confronted by those who insist upon the practical bearing of their speculations on the world of affairs. The world of affairs—covering all those who are dealing with practical farming—also has something to learn ; it may learn that researchers are in their way intensely practical and realistic, that they are trained to look for things which get

passed over in the hurry of industry and not to be satisfied with guesses or empirical solutions.

At a Conference, such as that at Cambridge, we have not only one but a team of researchers explaining the bearing of very different investigations on a large problem of agriculture. Confronting them is an audience, scientifically trained, but steeped in practical affairs. The result is a discussion stimulating to all. More than this, the meeting establishes personal links between those engaged upon a common problem—the application of science to agriculture—and leads the way to a quickened and persistent interchange of ideas which cannot but be fruitful.

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Report of Official Seed Testing Station

THE Ninth Annual Report of the Official Seed Testing Station for England and Wales, covering the period from August, 1925, to July, 1926, appears in No. 6 of the *Journal of the National Institute of Agricultural Botany*, copies of which may be obtained from the Institute, Huntingdon Road, Cambridge, price 1s., or post free 1s. 2d.

During the period under review, the total number of samples received for test amounted to 22,884. The sources of the samples, together with comparative figures for previous seasons, are as follows :—

		1925-26	1924-25	1923-24
Seed firms.	Number sending samples ..	1,732	1,741	1,354
	,, of samples received	18,375	17,695	15,831
Farmers, etc.	,, sending samples ..	676	625	310
	,, of samples received	1,404	1,034	769
Public Depts.	,, of samples received	3,105	3,165	2,286
Total number of samples		22,884	21,894	18,886

It will be seen that the total number of samples received for test during 1925-26 was 990 greater than in the previous season. The number of samples sent by seed firms shows an increase of nearly 4 per cent., and the increase in farmer samples is approximately 35 per cent. An analysis of the samples shows the following distribution according to species compared with similar figures for the two preceding seasons :—

	1925-26	1924-25	1923-24
Cereals	8,402	9,066	7,817
Pulses	2,601	1,891	1,714
Roots and vegetables	4,954	4,148	3,898
Clovers	4,280	4,283	3,304
Grasses	2,418	2,334	1,975

The number of cereal samples shows a decrease of about 7 per cent. on the previous season, owing largely to the drop in barley samples. Pulse samples increased by nearly 37 per cent., the number of pea samples being greater than in any previous year. Roots and vegetables show an increase of just over 19 per cent., being the highest figure attained since 1921-22. The number of clover samples, which includes 2,295 of red clover, is almost identical with the previous season, whilst the grass samples show a slight increase.

The number of samples received each month closely follows the curve of the average of the previous seven seasons, and was as follows :—

1925-26.			
August ..	736	February	4,155
September	2,008	March	4,700
October	2,725	April	1,791
November	1,567	May	485
December	1,630	June	194
January	2,739	July	154

Cereals.—The average percentage germination of wheat for the season under review was 95·8, being identical with the average of the previous eight seasons, but 2·7 per cent. higher than in 1924-25. The average germination of barley was 95·2 per cent., and of oats 93·8 per cent., the former being rather lower and the latter slightly higher than the average for 1917-24. Rye gave an average of 87·8 per cent. compared with 92·4 per cent. for the previous eight seasons, but in this case there was a marked decrease in the percentage of samples germinating below the authorized minimum.

A naked eye examination showed that 11·9 per cent. of the wheat samples were infected by bunt, and 2·7 per cent. with earcockles, whilst 6·9 per cent. of the barley samples showed smut, and ergot was present in 9·5 per cent. of the rye samples. In all cases, the percentage of samples showing evidence of these diseases was less than in the previous season.

A table is included in the Report showing the distribution of cereal samples received for test arranged according to variety. A comparison of this table with that of previous years shows only in certain instances a slight alteration in the " order of precedence."

Pulse.—The average germination of peas (84 per cent.) was below the average for 1917-25 (86·4 per cent.), but slightly better than in 1924-25 (83·5 per cent.). Field beans were slightly above the average (95·7 per cent. compared with

95·2 per cent.); broad beans were below the average (93·6 per cent. compared with 94·1 per cent.); runner beans were higher (82·2 per cent. compared with 77·3 per cent.); and dwarf beans considerably higher (93·1 per cent. compared with 83·2 per cent.).

Root and Vegetable Crops.—Field and garden turnip, rape, kale, brussels sprouts, broccoli, cauliflower, mangold, sugar beet, parsnip and carrot all gave a higher average percentage of germination than for the seasons 1917-25. Swedes were, however, down—80·5 per cent. compared with 85·1 per cent. —as were also onions—56·8 per cent. compared with 67·6 per cent.

Grasses.—The average germination of perennial rye-grass, Italian rye-grass, cocksfoot, timothy and dogstail showed an improvement on the previous season, but meadow fescue was slightly down. The average purity of all these kinds of grasses except dogstail was also better than the previous years. Dogstail showed a marked falling off in purity, the impurities increasing from 2·15 per cent. in 1924-25 to 4·6 per cent.

Clovers.—The average germination of red clovers (all samples) showed an improvement on the 1924-25 season, but was considerably less than the average for 1917-25. The purity, on the other hand, showed a marked improvement on the eight-year average. The average purity of English samples was higher than in any season since the Station has been established. Wild white clover gave an average germination of 75·2 per cent. as compared with 73·7 per cent. during 1917-25, an average of hard seeds of 10·8 per cent. compared with 14·2 per cent., and an average of impurities of 7·2 per cent. as compared with 10·44 per cent.

The percentage of samples of English clover containing dodder was lower than in any previous season—3·2 per cent. of samples. In the case of Chilian, the percentage of samples containing dodder was 89·1 per cent. and of New Zealand 25 per cent.

Investigations, etc.—In addition to the normal tests, particulars of which are given at the beginning of this note, over 4,200 tests of an investigational nature were carried out at the Station during the season. Further work was done with regard to the relationship between field and laboratory tests of peas and the occurrence of leaf stripe of oats. Some useful information was also collected in connexion with the loss of vitality in storage of certain economic crop seeds. Further problems which received attention at the Station include (1)

the incidence in commercial seed samples of seed-borne diseases (2) the identification of the seeds of (*a*) the various economic species of *Agrostis* (bent-grass), (*b*) forms and varieties of red and sheep's fescues, (*c*) the rye-grasses, (*d*) cultivated species of *Brassica*, and (*e*) wild white clover.

The Report adds: "There has again been a considerable increase in the number of inquiries dealt with by the Station in connexion with seeds and seed analysis. During the past season, also, a considerable number of small illustration plots have been grown of economic species of *Leguminosæ* and *Gramineæ*. These proved of considerable value, especially to students attending the Seed Analysts' Course, and it is hoped to extend such plots somewhat during the coming season."

The Report also includes a copy of the papers set, in the examination, in the principles and practice of seed testing, which was held at the Official Seed Testing Station in July, 1926.

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National Federation of Women's Institutes

SINCE the formation of the first Institute, in 1915, in a small Anglesey village, the Women's Institute Movement has spread with astonishing rapidity in the villages of England and Wales. Because it is a country movement and concerns itself little with propaganda, remarkably little publicity has attended its development. It is, however, now definitely recognized as an important factor in women's education and in public life, and its Annual Meeting is regarded as the country women's parliament.

The National Federation of Women's Institutes now consists of 3,845 Institutes, and has a membership of over 230,000. Each institute is entitled to send a delegate to the Annual Meeting. The agenda for this meeting reflects the varied interests of the different institutes—domestic business, questions peculiar to the country and matters of general public importance appearing upon it. This year the movement has reached a particularly significant milestone in its advance, for whereas in 1920 the National Federation received from His Majesty's Treasury a grant of £10,000 towards the general organizing costs of the movement, this year the movement is for the first time independent of Government aid as regards general expenses, the institutes having themselves built up the income necessary to finance their own organization.

The Annual Meeting was, this year, held in the Queen's Hall, Langham Place, London, W. 1, on May 31 and June 1, at 10.45 a.m.-5 p.m., the chairman of the National Federation Executive Committee, the Lady Denman, C.B.E., being in the chair, and the Minister was one of the speakers.

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Agricultural Returns

THE annual agricultural returns will be collected again this year on June 4. These returns are now compulsory under the provisions of the Agricultural Returns Act, 1925. Every occupier of more than one acre of agricultural land which includes orchard land, market gardens and nurseries, is required to make a return. The forms for the returns will be issued immediately before June 4, and when completed they should be forwarded to the Crop Reporter whose address appears on the back of the form. It is hoped that all occupiers will make their returns promptly so that there may be as little delay as possible in the publication of the tabulated results.

The Act provides that no individual return or part of a return may be used, published or disclosed except for the purposes of the preparation and publication of agricultural statistics, or of prosecutions under the Agricultural Returns Act.

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Agricultural Education in the United States

AGRICULTURAL education in the United States of America during the past 13 years has made remarkable progress through the development of the extension movement. This development dates from the introduction of the Smith-Lever Act in 1914, the keynote of which is co-operation. Prior to this Act, colleges were conducting considerable extension work with their own funds, and the Federal Department of Agriculture was spending, independently of the colleges, a further sum of $1,000,000. This work is now carried out by a single division, organized at the college, with a director at its head, appointed by the college with the assent of the Secretary of Agriculture. There is, further, co-operation between colleges in part of the extension work and in the plan for the voluntary pooling of all funds available for the various States.

In 1914, the State and Federal Governments were spending $1,600,000 on extension work in agriculture and home economics, and, by 1924, this figure had increased to $19,394,639 per annum, of which approximately $12,000,000 were contributed by the States and counties.

In the same period, the total personnel increased from 1,230 to 4,764 officers, the latter figure including 765 full-time specialists, extension directors and other supervisory officers.

In determining the policy of the extension work for a district, the farmers, with the agents of the co-operating county, State and Federal Governments, together review the local conditions and agree upon what ought to be done. The administration of the work is then entrusted to the State College of Agriculture. The full recognition of local people, conditions and practices, and the enlistment of the active participation of the individual farmer and his family in the planning and the carrying out of local extension work, are the two fundamental considerations to which the success is accredited. Demonstration farms owned and operated by the Government are being replaced by demonstration units owned and operated by the farmers under schemes developed jointly by the farmers and the Government agents. This partnership of the farmer with the Government, together with his work as a voluntary helper in the capacity of demonstrator, chairman or member of committee, has developed a sense of rural leadership, and given to the farmer a greater breadth of outlook, apart from the more direct benefit which accrues from the opportunity of improving his technical efficiency. The primary object of extension work, however, is the adoption of an improved practice, and there is evidence of a much wider use by farmers of lime, cover crops, green manures, fertilizers, seed of improved and standardized varieties, and of the improvement of orchards by renovation, pruning and spraying.

Farmers are advised as to the formation of co-operative organizations for the disposal of their products and for the purchasing of their supplies, provided with general information on marketing problems, encouraged to adopt better business principles, and stimulated to keep and utilize farm records as a means of regulating their business.

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THE GRASSLAND CONFERENCE AT CAMBRIDGE

A. B. BRUCE, M.A., Dip. Agric. (Cantab.)

THE Ministry of Agriculture made a happy choice in selecting grassland as the subject of its third conference of agricultural organizers. Grassland husbandry is of great topical interest —in view of the unchecked decline in arable land which recent statistics show, it could not well be otherwise—and it is a fortunate coincidence that, as Professor T. B. Wood pointed out, scientists are now entitled to present a philosophy of grass husbandry. That is to say, recent discoveries at Cambridge and, we must add, at the Rowett Institute at Aberdeen, as well as at Aberystwyth, justify scientists in giving precise scientific reasons upon which a definite rationale of the economic treatment of grassland can be based.

The Conference was attended by upwards of one hundred persons—agricultural organizers, teachers, research workers and practical agriculturists. The proceedings opened with a dinner at Gonville and Caius College on April 7, at which the Minister delivered an address dealing with the administrative and financial outlook of agricultural education and research. On behalf of the University and College authorities, Professor Buckland, President of the College, replied in a witty speech. The health of the Minister was proposed by the senior county organizer present, Mr. T. Hacking, of Leicestershire.

It is not proposed to give here a complete account of the proceedings during the following days. Readers who may wish to study the facts and figures presented by the various speakers are referred to the bibliography given below. It will be sufficient to present a reasoned summary and to indicate a few of the significant features of the interesting contributions made to the discussions that followed the reading of the papers.

The Rôle of Mineral Substances in Nutrition.—On the forenoon of April 8 the Conference had the privilege of having for its chairman Sir F. Gowland Hopkins, F.R.S., whose world-wide reputation as a pioneer in the domain of biochemistry needs no emphasis here. A discussion on the rôle of mineral substances in nutrition was opened by Dr. J. B. Orr, Director of the Rowett Institute. He reviewed the present position of knowledge on the subject, including some account

of recent discoveries made at Aberdeen. Up to quite recent years, the science of animal nutrition has been wholly concerned with what may be termed the grosser requirements of the animal in respect of the energy and repair balances as measured by its needs in proteins, carbohydrates and fats. The speaker, while emphasizing the continuing importance of these requirements—especially of the protein fraction—pointed out that the presence of definite, though small, quantities of "ash" substances is indispensable for the activation of the protein and carbohydrate constituents. Their absence or lack of balance may be the cause of malnutrition and the proximate reason, therefore, of disease, and that, in its turn, must react on the economic assimilation of the grosser body-building constituents.

As a guide to the absolute as well as the relative proportions in which mineral substances are needed for the health and working of the animal economy, Dr. Orr drew attention to the composition of the milk of animals in which the farmer is interested. The facts of evolution require that the food of the herbivores should show a close relation to the constitution of their natural food, that is, herbage; and as an index of the food requirements of any species, milk—the natural food of the young of that species—is the best index. When we study the natural food of herbivores, we at once recognize that natural conditions permit of a free range, whereas domestication for the purposes of man inevitably leads, if not to complete at least to a partial restriction of choice of diet. The importance of this consideration is brought home to us, also, when we consider two classes of inter-related facts which recent observation and experiment have brought to light.

First, actual analysis of herbage has shown that the mineral contents of natural grass vary from locality to locality; and, secondly, that the instincts of wild animals can be correlated with the presence or absence of certain minerals in the food they choose. Thus the migratory instinct, by force of which herbivores change their grazing grounds, can generally be correlated with mineral requirement. Again, depraved appetite (now known as *pica*), such as the eating of excreta and carrion, has been shown to be due to the absence of particular minerals in the ordinary diet. Of the latter perhaps the most striking instance can be given from the investigations of Theiler in South Africa. Cattle pasturing in the veldt were found to be suffering from a fatal disease due directly

to the eating of carrion. Theiler has shown that this depraved appetite is due to the deficiency of phosphorus in the herbage of the veldt, and that the addition of phosphates to the diet immediately abrogates the eating of carrion. More recently, Dr. Orr has shown that the progressive debility of the sheep stock in the Falkland Islands is due to the deficiency of lime in the pasturage there. Again, in New Zealand, there are regions in which an iron deficiency is found, accompanied by the prevalence of certain ailments in the grazing stock.

Generally speaking, scientists are now justified in stating (1) that a deficiency of minerals (whether it be the definite absence of one or more, or whether it be an *unbalanced condition of all*) leads to malnutrition, and (2) that a state of even minor malnutrition is followed by a predisposition to disease, sometimes definitely infectious, sometimes purely functional. Thus a deficiency in *lime* produces sterility, various forms of weakness of limbs and joints, rickets and roughness of coat; a deficiency of *phosphorus* causes stiffness of joints, lack of co-ordination of movements; lack of both lime and phosphorus seems to predispose to tuberculosis; deficiency of *iron* causes anæmia and low vitality of young; and deficiency of *iodine* leads also to loss of vitality, and in human beings to goitre.

To return to the significance of the mineral content of milk. The "ash" composition of cow's milk compares with that of pasture grass as follows*:—

	Calcium	Phosphorus	Chlorine	Sodium
Ash of cow's milk	1·7	1·5	1·4	·6
Ash of pasture grass (not hay)				
Good ..	2·6	1·2	3·5	·7
Poor ..	1·5	1·1	2·2	1·1

These facts emphasize two conclusions: (*a*) that good pasture (that is, natural pasture as improved by the skilled agriculturist) is a perfect food for young herbivores—cattle and sheep; (*b*) even poor (unimproved) pasture approximates in composition to milk.

Finally, Dr. Orr stressed a most significant fact. Under modern conditions, fatting cattle and milch cows are fed on large quantities of plant by-products. Cakes and meals are vegetable substances less nitrogenous and oily matter. These are all, also, more or less deficient in *natural* minerals; there is consequently a mineral drain on the animal body, which, in the case of milch cows, depletes the store of minerals

* These figures compare the content of quantities of equal feeding value of milk and grass respectively.

in the bones. Further, ultimately there is a mineral drain on the soil. Unfortunately, in the present state of knowledge, this drain cannot be definitely corrected, either by direct additions to the soil or by supplementing animal foods by definite "mineral mixtures." Again, it must be borne in mind that this drain is not merely absolute; it may be relative: the balance of mineral substances may be as important as the absolute amounts, and excess of certain mineral constituents may be as dangerous as deficiency.

In the discussion on Dr. Orr's paper, many facts confirmatory of his views were elicited, of which perhaps the most significant was the observation made by Mr. Hay, of Somerset, that in some cases he had observed that the incidence of tuberculosis in cows could be correlated with a lime deficiency in the soil. It may also be recorded that Mr. Boutflour, whose experience of cow rationing is very wide, finds that a mineral addition to cow rations often gives satisfactory results.

In closing the discussion, Sir F. Gowland Hopkins wittily suggested that, as the last man who had taken an interest in a grass diet died so long ago, it was difficult for him, a student of human nutrition, to take an active part in the subject of the Conference! He thought, however, that what had been said pointed to the importance of a conclusion to which his own researches had long been directed, namely, the supreme importance of small factors causing malnutrition and, ultimately, predisposition to disease.

The Function of Minerals in the Animal Body.—On the afternoon of April 8, Mr. J. B. S. Haldane, Reader in Biochemistry, gave a lecture on the function of minerals in the animal body. Of the experiments by which the lecture was illustrated, the most striking was a demonstration of the influence of a solution of mineral substances on the beating of a heart separated from the body of a rabbit. It was shown that a solution approximately of the same composition as sea water maintained pulsation indefinitely, while the omission from the solution of a single ingredient led to a cessation. Another striking demonstration was the action of minerals in relation to the proper functioning of such enzymes as ptyalin, the active principle of saliva. It was shown also that minerals generally are required for the activation of proteins, the free ions of the former determining the physical conditions (solution, etc.) of the latter. Coming to the specific action of inorganic substances generally, it is known that, apart from those present in the bones, they constitute less

than one per cent. of the animal body, and of these, calcium, phosphorus, potassium, sodium and magnesium bulk more largely than other necessary constituents such as iron, iodine, zinc and fluorine.

The Composition and Nutritive Value of Young Grass.—On April 9, the forenoon was occupied by an account given by Dr. Woodman of his recent researches on the composition and nutritive value of young grass, that is, grass in a condition before the formation of flowering stems, with its accompaniment of lignification, has set in. Briefly, the methods employed were the cutting of the grass with a lawn mower at weekly intervals, the drying of the produce, its analysis and the carrying out of digestion experiments with sheep. For purposes of comparison, plots were hayed and periodical cuts of the aftermath were taken. The experiments covered the seasons of 1925 and 1926 and were conducted both on light and heavy land. Figures were obtained showing by weekly intervals the total weight of fodder produced, its chemical composition, and the actual digestibility of the several constituents. Dr. Woodman put before the Conference a number of tables of relevant figures, accompanied by remarkably vigorous and lucid explanations and illustrations. The whole was of extreme value, furnishing as it did an example of careful scientific reasoning, surrounded, as all such reasoning must be, by the limitations which the conditions of the experiments necessarily impose. There is no feature more characteristic of modern research work than the essentially provisional nature of all scientific hypotheses, and the care that is taken to avoid the dogmatic certainty which so often characterizes the utterance of the non-scientific man.

The principal conclusions reached by Dr. Woodman may be stated briefly as follows :—

(1) The produce of closely grazed pasture has a higher feeding value than has hitherto been believed : the *dry matter* of young grass (not exceeding 3 to 4 in. high) may be characterized as a concentrated food of high protein content and remarkable digestibility ; it contains, moreover, adequate amounts of vitamins and of minerals such as lime and phosphorus. These characteristics persist during the whole grazing season from April to October.

Thus it was found, in two seasons and on soils of contrasted character, that the *dry matter* of closely mown pastures, in April to June, contained from 21 to 27 per cent. of crude protein, whereas the corresponding figure for hay (cut

June 25) was 9 per cent. In July the figure was, for pasture, 21-25, and for aftermath 18-23 per cent., and for weekly aftermath cuts in July-October the figures were 23-29 per cent. of crude protein.

Next as regards digestibility: The protein of pasture showed 77-85 per cent. digestibility, whereas the protein of hay showed only 56 per cent.

Next, the starch equivalents of the produce *per acre* over the whole season may be contrasted: From pasture cuts 2,300 lb., containing 680 lb. digestible protein; and from hay and aftermath cuts 2,450 lb., containing 430 lb. digestible protein. In regard to these figures, it should be noted that although when measured in terms of starch equivalent the produce in each case is much the same, the pasture cuts contain 50 per cent. more digestible protein.

Finally, the digestibility of the dry matter of pasture grass and that of the moisture-free content of an average sample of a feeding-cake may be contrasted.

Digestible Protein per cent.		*Starch equivalent per cent.*	
Pasture	*Cake*	*Pasture*	*Cake*
22	19-27	74	52-84

Digestibility of Organic Matter per cent.	
Pasture	*Cake*
84	58-80

(2) Under ordinary farming conditions, the dry matter of good pasture grass, *whatever its botanical composition*, retains the characteristics of a highly nutritious concentrate all through the grazing season, provided that it is kept closely grazed. Where the pasture is sparse and "poor," close grazing and the use of fertilizers to ensure density of herbage should be able to overcome any difficulty arising from inferior botanical composition.

This conclusion is justified by the following facts. The botanical composition of the two pastures under experiment differed widely; nevertheless, the analyses and feeding trials gave much the same results. Further, the botanical composition of each plot changed in the same season under treatment with no sensible effect on the results.

(3) A ration purely of young grass is unbalanced; it is too rich in protein and too deficient in carbohydrates. It should be supplemented by a carbohydrate concentrate such as a cereal grain.

This conclusion follows from a consideration of the figures given above.

The discussion which followed this paper was confined to a consideration of the bearing of the work on practical farming; that it will be profound, particularly on existing methods of management of grassland, was agreed by all the speakers. The extension of Mr. Woodman's investigations will be awaited with interest.

Sectional Grazing plus Nitrogenous Manuring.—On the forenoon of the third day of the Conference (Sir Daniel Hall in the chair), Mr. W. Brunton gave an account of his trial of the Hohenheim system of sectional grazing coupled with nitrogenous manuring. The system in question was fully described in an article published in the issue of this JOURNAL for September last, p. 498. Briefly it consists in stimulating the continuous growth of herbage by repeated applications of a nitrogenous manure (in this case sulphate of ammonia) and the rapid grazing down of the young produce followed by periods of 20-30 days' rest during which (if necessary) a further application of manure is made. Contrary to what has been taught and believed for a generation, this treatment has no evil effects on the quality of the herbage; no mat is produced, and—an unexpected feature—the growth of wild white clover is stimulated.

Mr. Brunton's experiment related to 27 acres of pasture land, a large part of which was originally of poor quality and set aside for grazing by horses. The whole area was divided into seven paddocks by means of rough four-wire fences, the two upper wires being barbed. Arrangements were also made whereby a pipe supply of water was available for the stock in each paddock. The trial has occupied two seasons—1925 and 1926. In the autumn of 1924, the whole area was treated with lime (15 cwt.), superphosphate (5 cwt.), and kainit (4 cwt.), followed by an application of sulphate of ammonia at the rate of 1 cwt. per acre. Further dressings of the last mentioned manure were made during both summers amounting in all, in some cases, to 4 cwt. per annum. The total cost of the fencing, manuring, etc., was at the rate of £4 6s. per acre. The results obtained in 1926 on the 27 acres were briefly as follows:—

MARCH 15. Grazing started with 30 ewes and 40 lambs.

April 8. Milch cows replaced sheep.

October 10. Cows removed.

OCTOBER 23–DECEMBER 31. 120 lambs at grass.

Total pasture days (stock carried multiplied by days of grazing), 8,555.

Average number of cows pastured 46, or 1·75 per acre.

The procedure was to stock the paddock at the rate of 10-12 cows per acre for 5 days; then to allow rests of 20-30 days, during each of which, if necessary, as judged by the growth of herbage, a dressing of sulphate of ammonia was given at the rate of 1 cwt. per acre.

Mr. Brunton is of opinion that, provided care and intelligence are exercised, the system is a sound business proposition. It provides a longer grazing period (note the early commencement and the late close); gives a great saving in the cost of concentrated food (no less than £164 in this case); enables more stock to be carried per acre; and leads to a great improvement in the amount and character of the herbage.

Mr. Brunton's conclusions were confirmed by the results obtained at Reaseheath Farm Institute, Cheshire, of which some account was given by Mr. Carr, Agricultural Organizer for the County.

The discussion which followed Mr. Brunton's address went to emphasize his view that a requisite of the new system is, above all, intelligent management. A point which requires study is the extent to which the system can be applied to ordinary farming; it was generally agreed that under ordinary conditions only a fraction of the grassland of a farm can be treated intensively—a considerable area must be kept for hay and rough grazing—and what this proportion should be remains in doubt. It should be noted, too, that so far no experience with fatting stock is available.

As a result of the enterprise of Messrs. Nitram, Mr. Brunton's experiment is being repeated at some 30 centres in the country. It is interesting to note that the remarkable results obtained confirm Dr. Woodman's work on the high feeding value of young grass.

In the afternoon the Conference listened to an interesting address by Mr. J. G. Stewart, in which a great many problems of grass husbandry were discussed. Mr. Stewart stressed the economic importance of providing winter keep, expressing a hope that plant breeders would give more attention to the practicability of either introducing or breeding a variety of grass endowed with the capacity of growing at low temperatures. A description was given of the experiments being conducted at Hohenheim, to which Mr. Stewart made a visit last summer. Among the notable features there was the luxuriant growth of perennial rye grass and white clover, and the fact that, although the treatment had been followed for ten years, no signs of deterioration were visible.

In the discussion which followed, Professor Stapledon made a valuab'e suggestion based upon what he had seen in New Zealand, namely, that it should be possible to practise sectional grazing without the necessity of providing special fencing. Mr. Carr, of Cheshire, gave the result of some observations he had made on the evil effects of small dressings of sulphate of ammonia on grassland. Mr. Bond, of Derbyshire, contributed an interesting speculation on the possible action of nitrogen on a dead mat of grass, in a manner similar to that observed by Hutchinson and Richards in connexion with the rotting of straw. In closing the discussion, Sir Daniel Hall suggested that the Hohenheim method would best be applied to second-class pasture.

Results of Grassland Trial Plots.—On the fourth day of the Conference (Mr. R. M. Wilson in the chair) Dr. Hanley, of Bristol University, read a paper summarizing the results obtained on the plots laid down in pursuance of the Ministry's grassland "campaign" initiated in 1919, and giving the deductions he had made as a result of his visits to these experiments. These reached the remarkable total of 700 in all, situated in 50 different counties. Dr. Hanley presented a classificat on of poor pastures, indicating in each case suitable means of improvement. In regard to these, his experience led him to doubt the value of indicator plants, such as *Calluna*, as a guide to treatment. The peats often presented an insoluble problem; downland, on the contrary, was the easiest of all to treat. Broadly speaking, in most cases either a complete manure, or phosphates followed by lime, gave the best results, but it was most important in all cases to observe that the full effect of mineral manures is shown under pasture conditions only. It is futile to measure results by taking a crop of hay. Except in the presence of a mat, the use of phosphates was generally successful, high solubility doing better than low. Dr. Hanley was strongly of opinion that further experiments in the use of phosphates in dry conditions, as well as in methods of improved management, were needed, but, on the whole, the grassland campaign had been productive of very useful results.

Grassland Botany.—On the forenoon of April 12, the closing day of the Conference, Professor R. G. Stapledon (Professor Scott Watson in the chair) read a widely ranging paper on grassland problems, considered mainly from a botanical stand-

point, and illustrated by an interesting series of graphs, embodying the results of the researches of the Welsh Plant Breed ng Station.

At the outset, the lecturer stressed the importance of two considerations: the effect of the nature of the herbage on stock, and the no less important consideration, the effect of the stock on the herbage. He showed a number of useful seasonal produce graphs of various species, demonstrating that the problem of maintaining a more or less constant supply of produce was dependent on securing some mixture of species. For winter keep he placed Italian rye-grass in the forefront. Generally speaking, a species had to be considered from many aspects, of which its productiveness, persistence and aggressiveness were the most important. The differences in mineral content should also be observed, coltsfoot, for example, being specially rich in phosphates. All round, the clovers were better mineral carriers than the grasses. Incidentally, the high mineral content of rape was emphasized. Professor Stapledon expressed some doubt as to the ability of certain pastures to withstand such a defoliation as a prolonged period of close grazing might entail. He also stressed the usefulness of temporary leys in providing abundance of keep at seasons when it is most needed.

Perhaps the most striking of the valuable series of figures presented by the lecturer was one correlating the laboratory germination percentage with the actual plant population resulting from the same seed. The figures showed conclusively that there is very little correlation between laboratory figures of germination and the actual proportion of plants finally established, the latter depending largely on variety. Great importance was attached to the proper arrangement of grassland, such as the optimum number of animals grazed and the duration of grazing. Belief was expressed in a system under which grass fields should be used both for hay and pasture in the same season.

In relation to grass mixtures, Professor Stapledon advocated a prescription involving a few species each of a suitable strain specially chosen to suit the particular soil and the particular style of farming pursued.

National Aspects of Grassland Husbandry.—The last address of the series was given by Professor T. B. Wood (Professor Sir R. H. Biffen in the chair), and was devoted to a consideration of the national aspects of grass husbandry as they were likely to be modified to suit new conditions, such as (1) the

progressive increase in the area of grass, and (2) the new knowledge now available. He showed that the bulk of the grassland was now producing a "coarse fodder" suitable for maintenance rather than for production. The new knowledge suggested that much of the existing grassland could be utilized for production purposes. What was needed was simply close grazing coupled with better management in the matters of stocking and manuring. On a consideration of the economics of the problem, it would appear that the head of stock carried under ordinary conditions would not be sufficient to eat down the grass in the flush season, and that, consequently, in view of Woodman's results, the surplus produce should be mown, and, if practicable, used (in a dry state) as a concentrated feeding stuff at seasons when growth was less active. Professor Wood presented calculations which showed that, in grazing inferior pasture, animals consumed a considerable portion of the available energy merely in walking about to find an adequate supply of food. As regards the system of sectional grazing advocated earlier in the Conference, it was suggested that farmers generally would have difficulty in putting up the capital needed.

In conclusion, Professor Wood, summing up the trend of the whole conference, suggested that scientists have now a philosophy of grassland husbandry to offer to practical men. Hitherto grass had been treated almost as a jungle product, which needed no special management and might be left to the mercy of nature. Scientific attention had in the past been concentrated on arable husbandry and comparatively little research had been done in the productivity of grassland. As a result of the converging attack of the botanist, nutrition chemist and physiologist, many new facts had come to light, the summing up of which should enable the husbandman to make a reasoned attack on what seemed to be likely to become the agricultural problem of the age—how to make the best use of our ever-increasing grasslands. At the close of his address, Professor Wood created great interest by distributing samples of a grass "cake" made under his direction from closely mown grass, subsequently dried in a malt house and then compressed into an adherent mass. Feeding experiments with this cake are about to be instituted with material to be supplied by Messrs. Nitram Ltd.

Finally, some reference to a domestic side of the Conference should be made. The arrangements for the housing of the members were excellent and directed by Mr. P. G. Dallinger,

the Ministry's Chief Inspector of Education. He, in his turn, feels that acknowledgments are due to Professor Wood and the Master and Fellows of Gonville and Caius College for the comfort which all attending the Conference enjoyed throughout the meeting.

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SOME COMMON AILMENTS OF THE DIGESTIVE ORGANS OF CATTLE

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Introduction.—Ailments of the digestive organs of cattle are necessarily important to the farmer, as they are of frequent occurrence, but can often be relieved by suitable "first-aid" treatment. The farmer should know the causes of such ailments and how they may be prevented; he should, also, be able to recognize the symptoms of each, and have some knowledge of suitable remedial treatment. In the present article, the more common ailments will be dealt with on the lines indicated, and in the order in which they naturally occur, beginning with those of the mouth. Cattle very rarely suffer from trouble with their teeth, to which no further reference is necessary.

Big Tongue.—The tongue is frequently the seat of a disease known variously by the names of big tongue, wooden tongue, timber tongue or *actinomycosis* of the tongue. This disease is more frequently met with in marshy, low-lying districts, and is caused by a fungus found on the stems of grasses. The spores of the fungus enter the tongue through small wounds, and these germinate, developing into actinomyces, or the ray fungus, so named from the way in which the club-like bodies radiate from a common centre. The ray fungus has

been found in man, in the lungs and liver ; in animals, in the tongue, the cheeks, the jawbone, and in the udders of milking cows and of sows.

Symptoms of Big Tongue.—At first, there is a falling away in condition, due to the inability of the animal to make full use of the tongue in grazing. There is a constant dribbling of saliva, and a soft, puffy swelling may form under the bottom jaw. If the tongue is examined at this stage, a few scattered hard nodules will be discovered in its substance. Later, the tongue becomes so much enlarged that it cannot be retained within the mouth, and the tip is seen protruding between the lips. The whole tongue is now very hard, stiff and rigid, and is useless for the purpose of drawing food into the mouth ; consequently, the animal soon becomes emaciated.

If a diseased tongue is examined after death, many hard nodules can be felt. If one is cut into, the centre may contain a little discharge in which can be discerned small yellowish bodies, about the size of a pin's head. These are the ray fungi, which, under the microscope, are seen to be composed of small, club-like bodies radiating from a common centre, as shown in Fig 1.

Treatment.—The farmer should know that, in the earlier stages, big tongue is curable. Various preparations of iodine are used to dose the animal, and are continued until symptoms of iodine poisoning occur, when the administration must be stopped for a time, and repeated later. Iodine has been found to have a specific action on the ray fungus, but its administration needs to be carefully watched by the veterinary surgeon.

In very advanced cases, where great emaciation arises from the inability of the animal to graze, a special method of feeding may be tried. Bring the animal into the shed ; place in the manger a round, flat-bottomed wooden tub, with straight upright sides about 18 inches in height, and half-fill the tub with short-cut food of a good feeding quality. It will be found that the animal is able to scoop up the food into its mouth, even if the tongue is quite useless. In this way, the condition may be slowly improved, and, in time, the animal becomes fit for the butcher.

Choking in Cattle.—The accident of choking occurs in the gullet and is generally caused by careless methods of preparing food, such as roots and cake. Roots should be sliced in a machine, and cake broken in a cake mill. Pieces of mangolds or turnips are apt to slip back in the throat and enter the gullet, but are too large to be swallowed and, lodging some-

where in the gullet, symptoms of choking are brought on. Sometimes the obstruction is at the entrance to the gullet and may be reached, with the aid of a suitable mouth gag, by the fingers and so removed; or the obstruction may be in the neck portion of the gullet, and the lump may be seen on the left side of the neck in the jugular channel. If lower down, where the gullet passes through the chest, there will be no outward sign of the obstruction. Choking in cattle is dangerous and may prove fatal in a short time, either from interference with the breathing or with the action of the heart.

Symptoms.—The beast will cough and make efforts to bring up the piece of food. Soon it will be noticed that a large quantity of saliva is escaping from the mouth. Choking does not cause any increase in the secretion, estimated, normally, at 112 lb. per day, but the obstruction in the gullet prevents the swallowing of the fluid. Sooner or later, more serious symptoms develop; the rumen, or paunch, becomes distended with gas, which cannot escape through the gullet as long as the obstruction remains. A swelling appears on the left side between the last rib and the hip-bone, and, when tapped with the fingers, gives out a hollow sound. The distended stomach presses on the diaphragm and interferes with the breathing, which becomes short and gasping. The animal now exhibits symptoms of acute pain, kicking at the belly with the hind feet, sometimes even attempting to lie down and roll like a horse with colic. With such symptoms, the animal is in great danger and may die suddenly. Prompt treatment is necessary to give relief by the use of the probang, or choke-rope. The old-fashioned choke-rope has now quite disappeared, and its place has been taken by another instrument, the probang. This is made of leather, stitched to form a long tube, armed at each end with a brass knob. Through the tube runs a piece of cane, which gives more rigidity; but it can be removed when the end of the probang has entered the stomach, so allowing a free escape for the accumulated gases. With the probang a wooden gag is supplied; this is a piece of wood with a hole in the centre and straps at each end, as shown in Fig 2. The gag is necessary for the safe use of the probang.

Passing the Probang.—For this operation three persons are required. The beast should first be loosened from the chain and brought into the gangway, so that there is plenty of room in front of its head. The gag is then placed in the mouth, like a horse's bit, and kept in position by the straps passed over the top of the head. Two men stand with the animal's

Fig. 1

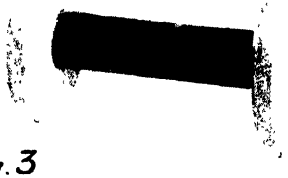

Fig. 3

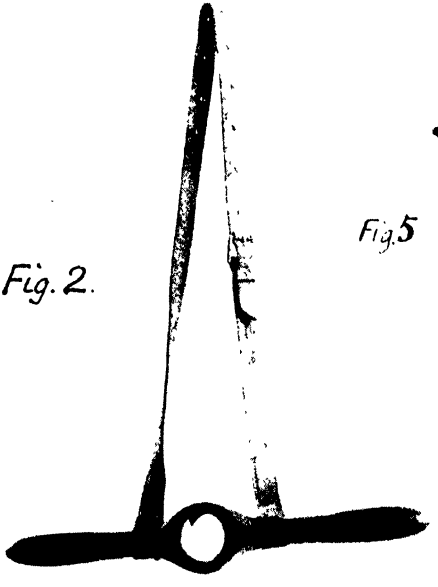

Fig. 2.

Fig. 5

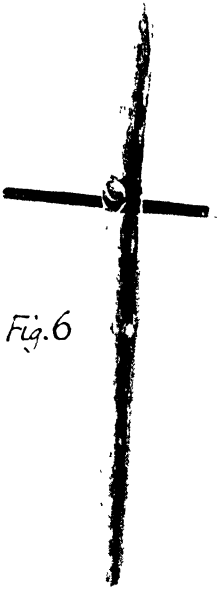

Fig. 6

Fig. 1.—The Ray fungus (after Crookshank).
„ 2.—Wooden gag.
„ 3.—Mouth gag.
„ 5.—Trocar and cannula.
„ 6.—Tube of elder stick with crosspiece.

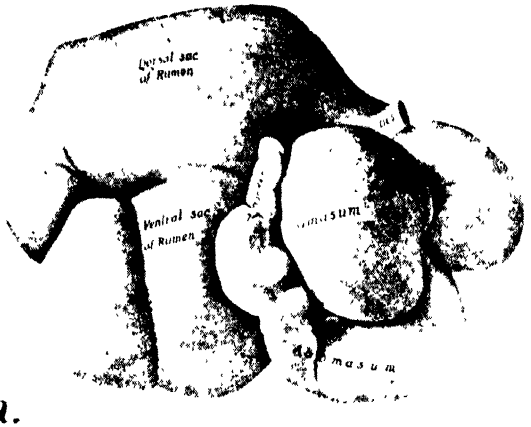

Fig 4a.

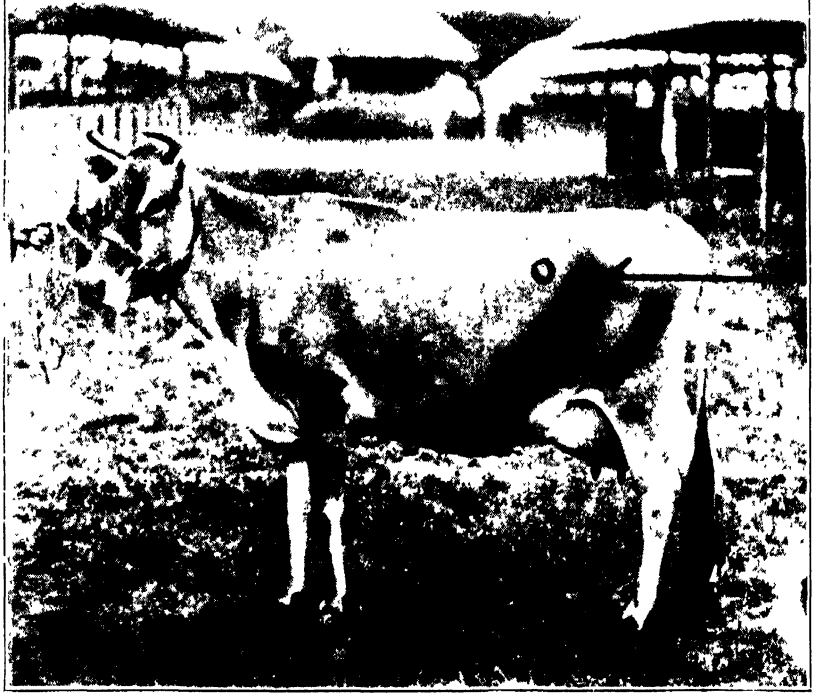

FIG. 4a. –Ruminant's stomachs: exterior (after Sisson).

„ 7. The circle indicates the place to puncture rumen on left side of animal, between the last rib and hip bone (after E. Matthews).

head between them, each holding a horn with one hand and one end of the gag with the other. The third man greases the probang and passes it through the hole in the gag and so through the mouth. When the end of the probang enters the throat, the animal often presses forward and must be restrained by the men holding the head. The operator must keep watch to see that the head, neck and body of the beast are in a straight line, otherwise the operation will be difficult and unsafe. The probang is passed farther into the gullet until the obstruction is felt, when the beast again presses forward and needs restraint. Here it must be said that the gullet is only a tube of muscle or flesh, and may easily be torn if the probang is roughly used. Keep up a firm, steady pressure on the obstruction, and in a few minutes it will begin to move, and, when once started, it can be pushed without difficulty right down to the stomach. When the end of the probang has reached the stomach, there will only remain outside the gag the end in the hand of the operator. The cane should then be withdrawn and the gases will escape rapidly through the probang. When all swelling of the stomach has disappeared, remove the probang and gag, but take care that the animal does not snatch a mouthful of hay or other food, or choking may occur a second time. Give no solid food for 24 hours; nothing but bran mashes or oatmeal gruel may be allowed.

In the absence of a probang and gag, do not use any makeshift instrument, such as a wagoner's whip, a leather harness trace, or an ordinary piece of rope. They are dangerous and have caused the deaths of many valuable animals. The idea that any piece of rope may be used to relieve choking probably arises from the old-fashioned name "choke-rope," but that was woven specially for the purpose and was used as the probang is to-day. If the proper instruments are not available, relief may be given and danger averted by placing in the mouth the kitchen paste or rolling pin (Fig. 3), secured by cords at each end passed over the head. In some way the paste pin, acting as a gag, prevents the dangerous accumulation of gases in the stomach, and affords the time necessary to secure professional assistance. Sometimes the obstruction disappears after a few hours without any other treatment being required.

In a few exceptional cases, where the distension of the stomach is very great, none of the above methods will be successful, and it is then necessary to puncture the rumen with a trocar, as is done to relieve acute hoven, described later.

After the distension of the rumen has been relieved by the use of the trocar, it is generally found easy to pass the probang down the gullet to the stomach.

The Stomachs of Cattle.—After the gullet, come the four stomachs of the ruminant, in which a number of ailments may occur. Only two of these need be mentioned as being common; the others are rarely met with. As the stomachs of a ruminating animal are somewhat complicated, it will be necessary to give a short description of the several compartments and of the process of rumination, or chewing the cud. The four compartments are :—

(*a*) Rumen, or paunch.
(*b*) Reticulum, or honeycomb.
(*c*) Omasum, or bible.
(*d*) Abomasum, or true stomach.

The diagram (Fig. 4) may help the reader to follow the description. The rumen (A) is by far the largest of the four and occupies nearly half the abdominal cavity. It lies on the

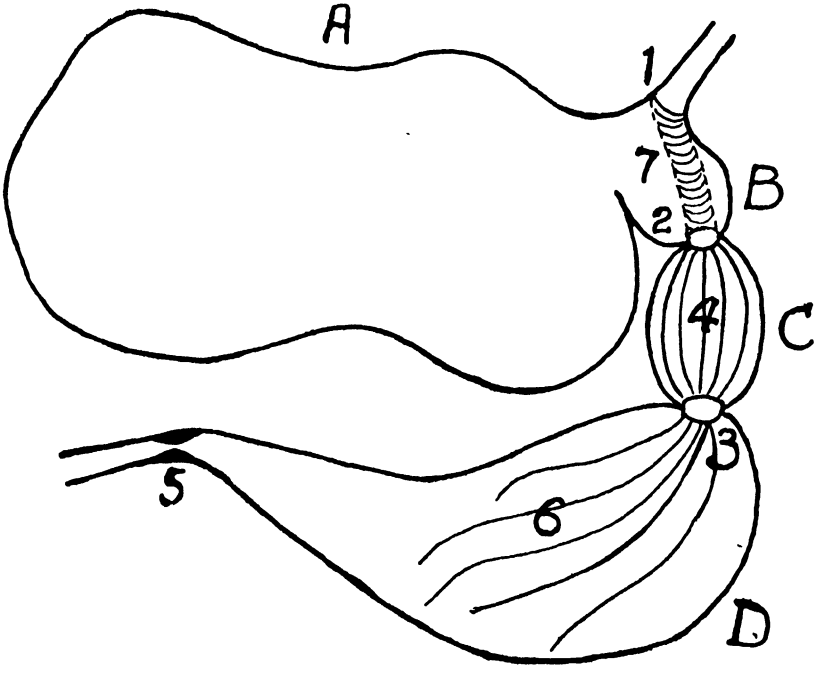

FIG. 4.—Diagram of ruminant's stomachs. (Interior.)

left side of the body, extending from the diaphragm to the entrance to the pelvis. It has a very powerful white, involuntary muscular coat, and is lined by mucous membrane, which is white in colour and presents on the greater part of

its surface a large number of leaf-like papillæ. All the food the animal eats passes down the gullet and enters the rumen at (1), where it is stored up until the appetite is satisfied and rumination begins. The second stomach (B), the reticulum, or honeycomb, is the smallest of the four, and is placed in front of the rumen and under the lower end of the gullet (1). It is recognized by the honeycomb pattern on its mucous membrane. The third stomach, the omasum, or bible (C), is placed in front of the rumen to the right of the reticulum. It is oval in shape and about the size of a Rugby football. A circular opening (2) admits food from the reticulum, and another opening (3) communicates with the abomasum (D). Between the two openings there is a large number of parallel leaves (4), like the leaves of a book; hence the name bible stomach.

The fourth stomach (D), the abomasum, or true stomach, is pear-shaped and next in size to the rumen. It is situated on the right side of the rumen and communicates with the small intestine at (5). The fourth stomach is the only one in which gastric juice is secreted, and it is here that digestion of certain constituents of the food takes place. The interior of the stomach is lined by a smooth, slippery and pinkish mucous membrane, containing peptic glands which secrete the gastric juice. There are a few spiral leaves (6) in this stomach.

Uses of the Stomachs.—The rumen, or paunch, acts as a storehouse for the food while the animal is grazing. When the rumen is full, rumination, or the chewing of the cud, begins. This sending up of the cud is effected by contractions of the powerful muscular coat of the rumen, forcing the food mass forward and pressing a portion into the lower end of the gullet (1). The gullet next contracts from its lower end, driving the food upwards towards the mouth, where the chewing of the cud is carried out slowly and deliberately. At the same time, more saliva is mixed with the food in the mouth. When ready, the cud is again swallowed and, on reaching the lower end of the gullet, is diverted by means of a special groove (7) through the reticulum into the omasum, where the food is passed and squeezed between the leaves, and the liquids escape into the abomasum, to be followed later by the solids, which have now been thoroughly prepared for the action of the gastric juice in the fourth stomach. The duty of the first three stomachs is to prepare the food for the digestion, which is carried on in the fourth stomach.

The rumen is never empty, as the chewing of the cud ceases when two-thirds of its contents have been removed. All the food in the rumen *must* be returned to the mouth for the chewing of the cud. No food passes from the rumen and reticulum directly into the omasum and abomasum. If rumination is suspended, as during illness, the food remains in the rumen until the act of chewing the cud is resumed, and it is quite possible for the animal to starve although the rumen contains a considerable mass of food.

Liquid foods, which do not need chewing over again, can pass directly to the omasum and fourth stomach. In all cases of illness, during which rumination is suspended, liquid foods, such as oatmeal gruel and linseed cake porridge, must be given in place of ordinary foods, so that the strength of the animal may be maintained until convalescence is reached and rumination is resumed.

As might be expected, the large and complicated stomachs of the ruminants are liable to suffer from various ailments, but in this article it is only proposed to refer to two, both of which affect the first stomach, or rumen.

Impaction of Rumen.—This ailment, also known as mawbound, or loss of cud, is of frequent occurrence in dairy cows during the winter months. It is generally due to errors of feeding, such as too much short-cut food, brewers' grains, etc., or any food which the animal eats to excess. Foods of poor quality, as bad, mouldy hay, may derange the stomach and cause loss of cud.

Symptoms.—In a dairy cow the first symptom will be a decrease in the milk yield, loss of appetite and loss of cud. The animal has a peculiar grunt or groan, and grinds the teeth together. The rumen can be felt on the left side between the last rib and the hip-bone, and is found to contain a solid mass of food, and the movements of the stomach can no longer be felt. The dung is harder and coarser in texture than in health. A simple explanation of this loss of cud is that the muscular coat of the rumen is suffering from overwork and needs a rest.

Treatment.—First-aid measures consist in giving the stomach a much-needed rest. It is useless to give repeated purgative doses, as they have no effect on the rumen, but a single dose is useful to relieve the constipation. No solid food should be given, as it will only add to the impaction of the rumen. Only liquid foods, such as oatmeal gruel and linseed cake

porridge, or a mixture of the two, are useful, and should be given to the extent of two or three gallons daily.

Sometimes the animal will drink part of this quantity, but more often it has to be given with a drenching horn. The liquid food passes directly to the fourth stomach, where it is digested, and the nutriment is absorbed into the blood from the intestine.

After a few days of this special diet, the muscular coat of the rumen will be rested and the chewing of the cud will be resumed. When it is certain that the animal has begun to chew the cud, a little good hay may be given, sprinkled with common salt. The salt freshens up the contents of the rumen and induces the chewing of the cud.

Prevention.—To prevent impaction of the rumen, sufficient long hay should always be given when short-cut food and brewers' grains are being fed to cattle. During the winter months, an allowance of common salt is desirable, given daily sprinkled over the food.

Hoven, blown, dew-blown or tymphanitis, is the distension of the rumen by gases which are formed by the fermenting food contents. Normally, a certain amount of fermentation goes on in the rumen and the gases produced are expelled through the gullet by frequent eructations, but in hoven the fermentation has been so rapid that large volumes of gas are produced, causing rapid distension of the stomach. Hoven occurs in three forms—acute, sub-acute, and chronic.

Acute Hoven.—This is caused by the rapid fermentation of green foods, such as young clover, young growing corn, or fresh green grass, especially when such foods are wet with dew or rain. Cattle straying into a field of growing clover frequently suffer severely. They eat the fresh green food greedily and quickly, overfilling the rumen, which is then unable to perform its proper function of sending up the cud; fermentation of the food occurs, evolving large quantities of gas, which cannot be expelled rapidly enough to prevent distension. Sometimes acute hoven occurs in the winter and is due to eating frozen roots.

Symptoms of Acute Hoven.—These are unmistakable. The animal is so badly blown as to appear deformed. The swelling of the stomach is seen on the left side of the body, between the last rib and the hip-bone, and may be very large. On tapping the swollen part with the finger-tips a hollow, drum-like sound is produced. The animal is in great pain, bellows loudly and may try to lie down and roll, but quickly gets up

again, as breathing is interfered with in the recumbent position. Owing to the pressure of the distended rumen on the diaphragm, breathing is difficult, quick and shallow. The pressure may also interfere with the action of the heart, and the animal dies quickly either from suffocation or heart failure.

Treatment.—This must be prompt, as the animal is in extreme danger. Medicines are useless, and the only thing to be done is to *puncture the rumen* in order to let the gas escape quickly and so relieve the pressure. This operation can be safely and successfully performed by the farmer himself if he possesses a suitable trocar and cannula (Fig. 5). The trocar is the dagger-like instrument, with a blade seven or eight inches in length and oval in shape; the cannula is a metal tube which forms a sheath for the trocar, but is about an inch shorter than the latter, so that the pointed end of the trocar projects beyond the cannula.

The animal should be placed with its *right* side against a wall or gate, a rope or kicking strap should be fixed on the hind legs above the hocks, and the head secured by the "bull-dogs" placed in the nose. The operator takes the trocar and cannula in his right hand, places the point of the instrument on the skin equidistant between the last rib and the hip-bone on the left side, and about a span beneath the loin-bones (Fig. 7). Then, with a sharp, quick thrust, the trocar is driven into the stomach, carrying with it the cannula. The trocar is quickly withdrawn, leaving the cannula in position in the wound to act as an escape tube for the gas. As the gas comes away, the swelling rapidly subsides and the distressing symptoms disappear. The cannula should be kept in place for several hours, during which time an attendant must remain with the patient and take care that the tube does not get displaced. When the tube is removed the wound rapidly closes. In the absence of the trocar and cannula, the operation can be done with a long-bladed knife, but some kind of tube *must* be inserted in the wound after the withdrawal of the knife. A piece of elder-stick, with the fibre removed, answers the purpose very well if a short piece of stick is lashed to the tube near one end (Fig. 6).

A very simple way of inserting the elder stick is to pass through the tube the steel used for sharpening the carving knife, and in this way guide the tube through the wound into the stomach, and then withdraw the steel. If some kind of tube is not used, the wound closes up in a short time and

the stomach may again become distended with gas, necessitating a repetition of the operation, which is not advisable.

Sub-acute Hoven.—This is due to causes similar to those in the acute form, but the distension of the rumen is less severe and no other symptoms are seen beyond the swelling.

Treatment.—There is no need to puncture the rumen in this case. Two ounces of aromatic spirits of ammonia may be given in a quart of cold water as a drench. Walking exercise is often sufficient to relieve the slight distension.

Chronic Hoven.—In this the swelling occurs daily, and is often caused by foreign bodies, wire nails, etc., in the rumen or reticulum. In such cases little can be done to give permanent relief, but temporary relief may be obtained by drenching as above, or by the use of the probang, which is passed down the gullet to the stomach as in the case of choking, withdrawing the cane to allow the gas to escape through the tube.

Ailments of the Second, Third, and Fourth Stomachs.—Ailments of the reticulum, omasum and abomasum may occasionally occur, but are uncommon and difficult for the farmer to diagnose.

White Scour, or Diarrhœa.—This is of common occurrence in young calves and often very fatal. It will be convenient to describe the malady as :—

(*a*) Ordinary white scour.

(*b*) Contagious white scour.

Ordinary White Scour.—Pail-fed calves are particularly liable to suffer from this ailment when they are a few weeks old, the predisposing cause being errors in feeding, giving rise to non-digestion of the milk and subsequent diarrhœa. The fæces are very liquid and offensive, and white in colour on account of the presence of particles of curd.

When a calf is suckled by its mother, as Nature intended it to be, it takes milk many times in the twenty-four hours and in moderate quantities at a time. The milk swallowed passes directly to the fourth stomach, where it meets the gastric juice and is curdled by the rennin in that fluid. The curd so formed from cow's milk is very solid, but can be digested by the other constituents of the gastric juice, pepsin, etc., and completely dissolved. After each meal, the milk taken should be completely digested.

When the calf, however, is taken from the cow immediately after birth, and is pail-fed three times a day for the first fortnight and afterwards only twice a day, it becomes thirsty

and hungry, and takes far too much milk at each meal. This results in the formation of a large mass of dense curd which can only be partially digested. Sometimes the undigested curd becomes hardened and leather-like, remaining in the stomach, where it acts as an irritant, and may be found there on post-mortem examination. Generally, the undigested curd undergoes decomposition by the action of microbes and is broken up into small particles which escape from the stomach into the intestine, acting there as an irritant poison and causing the offensive diarrhœa. Much of this trouble could be avoided by a more rational method of feeding, in which the same quantity of milk is allowed as in the two or three meals, but the number of meals is increased to not less than four, a smaller amount being given at each. Although this entails additional labour, the calves will thrive better by having smaller quantities of milk at shorter intervals.

Treatment.—The treatment usually adopted by the farmer is to dose with laudanum and castor oil, but, as the one drug counteracts the action of the other, such treatment should not be followed. It is far better to give a suitable dose of castor oil alone directly the diarrhœa begins. The purgative action of the oil helps Nature to get rid of the poisonous curd which is irritating the bowel; and, when the oil has acted, the diarrhœa may cease without further treatment being necessary. Should the diarrhœa, however, persist for twenty-four hours after the administration of the oil, laudanum may then be given to soothe the irritated bowel. A very homely but useful remedy at this stage may be prepared by mixing together one teaspoonful of laudanum, one tablespoonful of brandy, and one teacupful of made starch. This dose may be given two or three times a day until the diarrhœa ceases.

Diet.—The milk should be boiled and diluted with one-third the quantity of water. In obstinate cases, milk should be discontinued for a time, the calf being fed entirely on calf meal.

Contagious White Scour.—This trouble is caused by the entrance of microbes into the body, either through the untreated navel or through the mouth with the milk. The disease occurs within a few days after the birth of the calf and is very fatal. It has been estimated that from 70 per cent. to 100 per cent. of calves so affected will die.

Professor Nocard inquired into the cause of the disease many years ago, and suggested a method of preventive treatment which has proved very successful. He found that filth

organisms entered the circulation through the untreated navel and increased rapidly in the blood, causing diarrhœa and extreme exhaustion, which, in many cases, proved fatal in a few hours.

Preventive Treatment.—A ligature should be put on the navel string, about an inch from the belly, immediately after birth, and the navel string should be painted with a strong antiseptic. For the ligature the farmer will find it useful to have a knot of narrow white tape, kept in a wide-mouthed bottle in (95 per cent. pure) carbolic acid. An effective antiseptic is iodized rhenol, which can be applied to the navel with a soft brush after the ligature has been put on.

Since Nocard's investigation it has been found that a certain proportion of these cases may be due to the bacillus *coli communis*, which enters through the mouth with the milk. This organism is constantly present in the intestine of older animals and is not harmful to them ; but if calves become infected, the multitude of bacteria irritates the intestine, causing diarrhœa. Where these cases occur the calf place needs thorough cleaning and disinfection. All dirty litter must be removed, the walls limewashed, and the floor and drains washed down with a strong disinfectant. After cleansing, the doors and windows should be kept wide open, with the place empty, for several weeks, so that Nature's best disinfectants, sunlight and fresh air, can complete the destruction of all dangerous organisms.

* * * * * *

PACKAGES FOR EGGS AND DRESSED POULTRY

IN December, 1926, a Committee* was appointed by the Minister of Agriculture and Fisheries to examine the various kinds of packages in use in the trade in home-produced eggs and dressed poultry, and to make suggestions with a view to

* Constituted as follows :- Mr. H. German, National Farmers' Union and Poultry Advisory Committee ; Mr. P. Hedworth Foulkes, B.Sc., Poultry Advisory Committee ; Mr. H. W. Board, West of England Egg and Poultry Merchants' Association ; Capt. A. Keevil, O.B.E., M.C., Poultry Advisory Committee and Market Salesmen and Wholesalers ; Mr. W. H. Key, Market Salesmen and Wholesalers ; Councillor G. Hall, National Federation of Fruiterers, Florists and Fishmongers ; Mr. S. G. Shaw, Federation of Grocers' Associations, Mr. R. Steel, National Federation of Dairymen's Associations, Retailers ; and Mr. F. Harrison, the Railway Companies. The Chairman was Mr. A. W. Street, C.I.E., M.C., and the Secretary, Mr. G. W. Thomas, both of the Ministry of Agriculture and Fisheries.

standardization. The main outlines of the Committee's Report are given below.

General.—The present position, as regards packages, in both the home and imported trade, is fully described in the two Reports* recently issued by the Ministry on the Marketing of Eggs and Poultry respectively. It is sufficient, therefore, to draw attention to the basic fact that special care is taken in countries which export to the British market to ensure that their produce is attractively packed in accordance with modern requirements. In many countries, notably in Northern Ireland, the Irish Free State, Canada, and South Africa, this care is enforced, in respect of eggs, by law.

EGG PACKAGES.

(a) Non-returnables. *Views of the Trade.*—A questionnaire was sent out by the Committee to a number of wholesale merchants in a large way of business, and, in 55 out of 64 replies received, a preference was expressed for non-returnable cases; this was qualified, in one or two instances, by the statement that, although non-returnables were best for consignment by rail, a returnable case was more convenient when eggs were sent by road. Fourteen replies were definitely and exclusively in favour of the 60 dozen case with wood-wool packing; a preference for 30 dozen cases, with fillers and flats, was shown by the remaining 50, of whom a number stated that they saw no objection to the 60-dozen case. A few of those who favoured a 60-dozen case suggested the use of fillers and flats in the place of wood-wool. An important rider, added in many instances, was "provided the cases are new"; the use of second-hand boxes which have conveyed eggs from overseas is liable to impart a musty flavour to the eggs and is objectionable on other grounds.

Non-returnables Advocated in Principle.—In view of the marked trade preference for non-returnable packages, it is not difficult to understand that the persistence of the returnable in the trade in English eggs is causing distributors, in increasing numbers, to decline to handle the English product. As one large merchant said in reply to the questionnaire, "Over 95 per cent. of our trade is in foreign eggs, for the simple reason that we cannot afford the time taken in sending out our vans to collect returnable empties from our retail customers." Bearing in mind the fact that all imported eggs arrive in non-returnable packages, it is evident that something

* *Egg Marketing in England and Wales* (Economic Series. No. 10). *The Marketing of Poultry in England and Wales* (Economic Series, No. 11).

FIG. 1. -A medium-priced English *Returnable*.

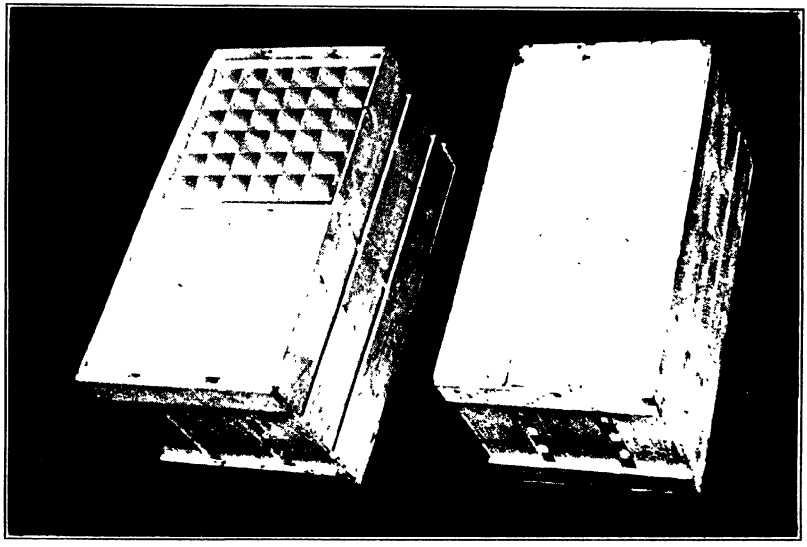

FIG. 2. An Irish 30-dozen *Non-returnable*.

FIG. 3.—An Irish 60-dozen *Non-returnable*.

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FIG. 4.—An English *Non-returnable*.

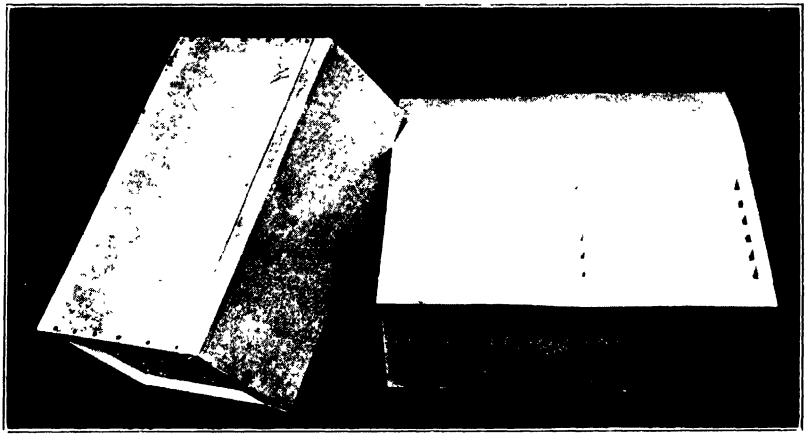

FIG. 5.— A fibre-board *Non-returnable*

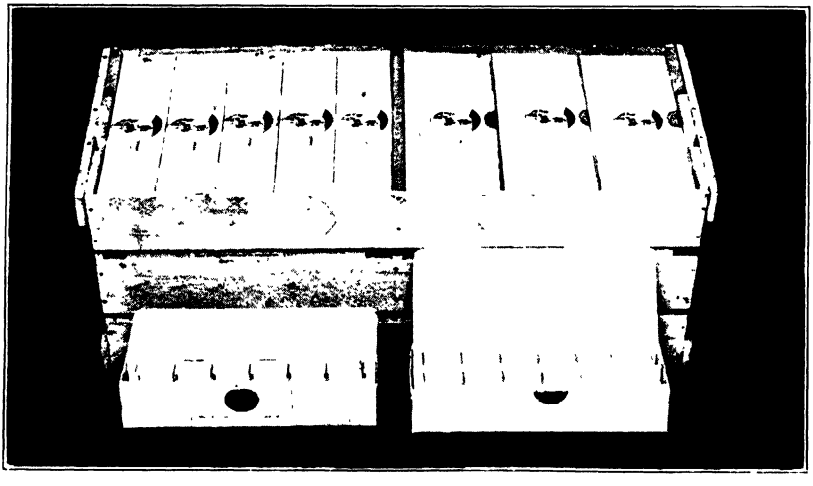

FIG. 6.—A *Non-returnable* with *Cartons*.

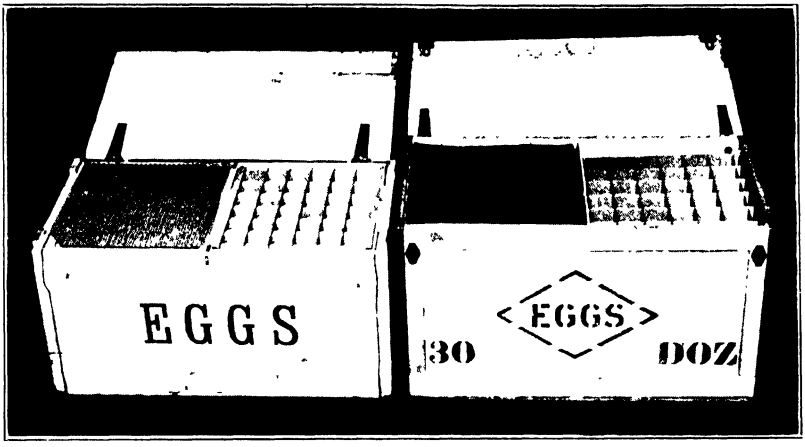

FIG. 7.—Two typical *Returnable* boxes

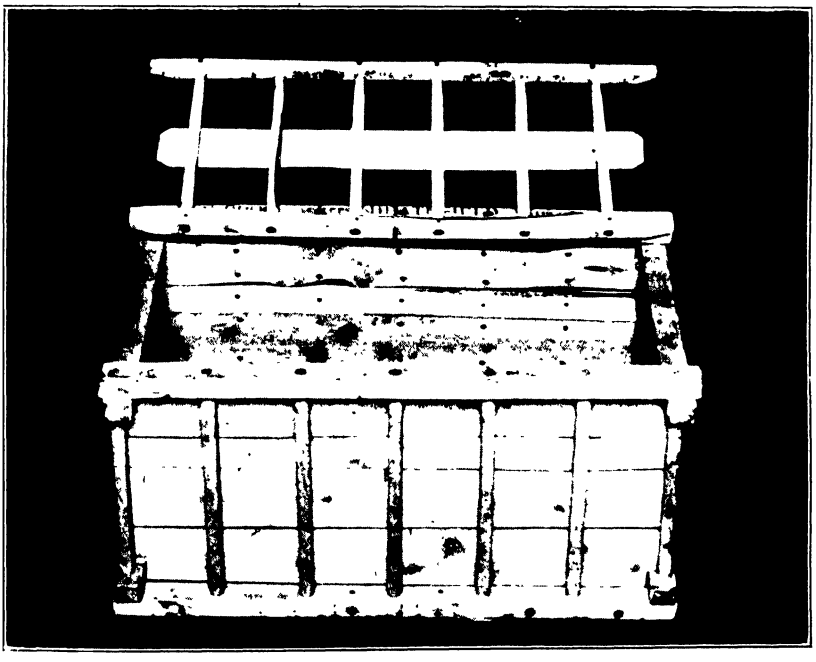

FIG. 8.—A "ped"; used in the Heathfield district of Sussex.

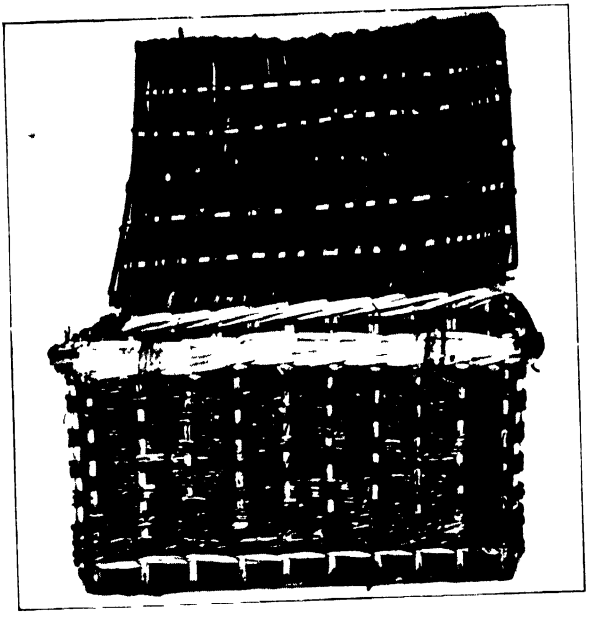

FIG. 9.—A typical dressed-poultry hamper.

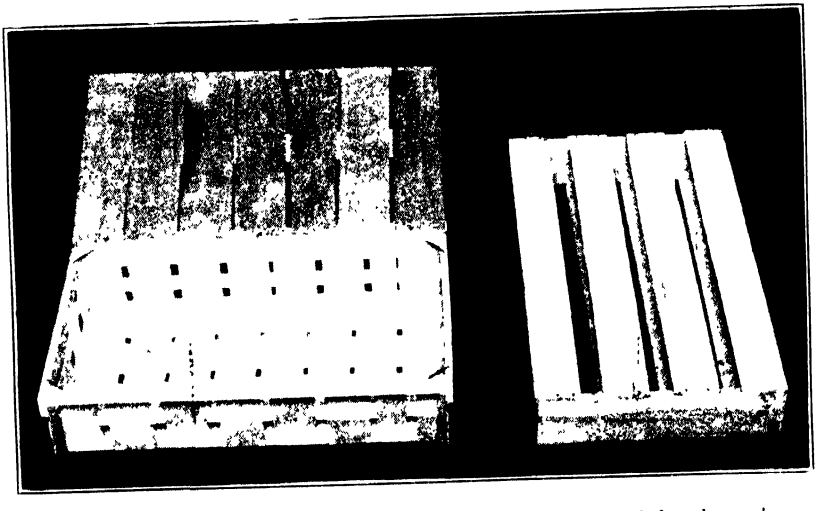

FIG. 10.—*Chip* and *Wooden Non-returnables* recommended for dressed poultry.

must be done, and done quickly, to introduce a non-returnable package which will improve the position of the English egg on the wholesale markets of this country. In the United States, the expense, trouble, annoyance, and waste of time caused to the distributive trade by having to recover, sort, store and return cases to senders was such as to bring into use a cheap case which could be *given away* with the eggs. This, moreover, was not for an export trade, but for a *domestic* trade. What the American producer and packer have done to save time, trouble, and inconvenience in a market which is practically secured to their own product must also be done here as a matter of urgent necessity if home produce is not to lose ground in competition with imports.

The following resolution, which was passed in April, 1927, by the Joint Egg-Marketing Committee of the National Farmers' Union and National Poultry Council is, therefore, of special interest :—

> That the National Farmers' Union and the National Poultry Council, in conjunction with the Ministry of Agriculture and the Railway Companies, agree to a standardized, non-returnable package which could be recommended for adoption by packers of English eggs.

Types of Non-returnables Examined.—The Committee examined 12 wooden boxes and one fibre-board case of the non-returnable type, 30-dozen in capacity, fitted with fillers and flats ; Irish 60-dozen and 30-dozen cases with wood-wool packing ; a Cornish 50-dozen case packed with straw ; a wooden box from Northern Ireland, holding 30 dozen, fitted with one-dozen and half-dozen cartons in the place of fillers and flats ; also cardboard containers holding 15 dozen eggs packed in fillers and flats.

Comparative Costs of Returnables and Non-returnables.—For the purpose of comparing the cost to the packer of returnables and non-returnables, the following boxes were selected :—

(1) A returnable box, costing 8s. 6d., of the customary 30-dozen type with fillers and felt flats. Similar boxes are used in the West of England in large quantities with satisfactory results. (Fig. 1.)

(2) A non-returnable box of cheap construction such as is used for the Irish trade and is obtainable in that country at as low a price as 1s. 9d. (including fillers and flats) when ordered in quantities "in shooks." The lowest English estimate is 2s. 0d. "made up." (Fig. 2.)

(3) A Cornish 50-dozen case, which, originally designed as a non-returnable, is now commonly used as a returnable. This box, without straw for packing, costs 1s. 7d.

(4) An Irish 60-dozen non-returnable case which can be manufactured in Ireland "in shooks" for as little as 2s. 1d. in large quantities. This price does not include the cost of the wood-wool for packing. The lowest English estimate is 2s. 9d. "in shooks," or 3s. 2d. "made up." (Fig. 3.)

The following table gives an analysis of the cost of each of these packages to the packer per 120 eggs per journey :—

Type of box and packing material	Weight	Cost without packing material	Cost of case and packing material	Cost to packer of case and packing per journey	Cost to packer of case and packing per 120 eggs per journey
	lb.	s. d.	s. d.	s. d.	d.
Returnable (30-doz.). Fillers and flats ..	24·5	4 0	8 6	0 7†	2·3
Non-returnable (30-doz.). Fillers & flats	12	1 0‡	1 9	1 9	7
Cornish (50-doz.). Straw	18*	1 7	2 0	2 0	4·8
Irish(60-doz.). Wood-wool	29*	2 1‡	3 0	3 0	6

* Without straw or wood-wool. 5 lb. should be added for straw and 12 lb. for wood-wool.

† This figure (the actual cost per journey allowing for losses, renewals, and repairs) is quoted by a large firm in the West of England. It is confirmed by independent figures supplied by a firm operating in the Home Counties.

‡ Purchased "in shooks"; the price does not include delivery. Cost of making up is about ½d. per 120 eggs.

It is clear that, on prime cost, returnables are cheaper to the packer than non-returnables, even when minimum Irish prices are taken for the latter. Having regard, however, to the fact that a 30-dozen returnable case is, generally, about 12 lb. heavier that a non-returnable, being more substantially constructed, a certain saving, estimated at not less than 2d. per 120 eggs, in transport costs on the outward journey is effected when comparable non-returnables are used. Taking this into consideration, a returnable 30-dozen case may be said to cost the packer a little over 4d. per 120 eggs as against 7d. for a non-returnable of a similar type, 4·8d. for a Cornish 50-dozen case, and 6d. for the Irish 60-dozen, plus cost of assembling the cases.

These are the ultimate comparative costs, but there are other factors to be taken into consideration which cannot be precisely measured. For instance, when non-returnables are used, less capital is required; the packer does not have to consider whether he will have sufficient empties available for his next consignment, and he is saved the trouble of putting cases into a fit condition for another journey and of

replacing damaged or soiled fillers and flats; he is also saved cost of collecting empties from station.

On the distributive side, the non-returnable saves time and worry at every turn. It also saves expense; the cost of returning the empty, which may be reckoned as averaging out at 4d. a journey, is saved, and it is usually possible to realize anything from 3d. to 6d. for the package as firewood.

Thus, while both sides are saved worry and trouble, the use of non-returnables involves the *packer*, whether producer or country wholesaler, in an additional charge of 3d. per 120 eggs (30-dozen case) and 2d. per 120 eggs (60-dozen case), excluding cost of assembling the cases, whereas the *retailer*, for his part, stands to benefit to the extent of about 3d. per 120 eggs.

Although it is less a question of whether packers can afford the extra cost of non-returnables than whether they, in the interests of their market, can afford to continue *not* to use them, it would nevertheless be only equitable if retailers agreed to make some concession in price for home-produced eggs so packed. A difference in price of, say, 4d. per 120 eggs, or 1s. for a 30-dozen case, or 3d. per 120 eggs, or 1s. 6d. for a 60-dozen case, would reimburse the packer for his additional expenditure.

A number of associations have recently passed the following resolutions bearing directly on this point:—

(1) *The Metropolitan Grocers', Provision Dealers' and Oilmen's Association.*

"That this Association, being anxious to encourage any action calculated to improve the marketing of home-produced eggs, and realizing the commercial disadvantages to the home industry of the returnable package system, recommends members:—

(*a*) To give a preference, where practicable, to home-produced eggs packed in non-returnable cases, quality and other considerations being equal, and

(*b*) To recognize the saving to the trade in time, labour, expense and trouble, when non-returnable cases are used by offering a slightly higher price over current market rates for eggs so packed."

(2) *West of England Egg and Poultry Merchants' Association.*

"With a view to removing the handicap which the use of returnable packages admittedly imposes on the English egg trade when in competition with imported supplies, this association recommends its members to send eggs in non-returnables whenever distributors are prepared to make a reasonable concession in price in consideration of non-returnables being used.

"This association further advocates legislation compelling the adoption of a non-returnable case to be used once only."

(3) *National Federation of Dairymen's Associations.*

"Declared itself to be in favour of the packing of eggs in non-

returnable cases, notwithstanding the fact that the use of such cases might slightly increase the price."

(4) *National Federation of Retail Fruiterers, Florists and Fishmongers.*

"This federation, being impressed with the urgency of improving the marketing of home-produced eggs in view of the competition of supplies from overseas sources, and believing that one step in the right direction would be the use of non-returnable packages, and further that there are ways in which the distributive trade would be willing, in the interests of the home country, to help to that end, recommends members :-

(*a*) to give a preference, where practicable, to home-produced eggs packed in non-returnables, quality and other considerations being equal, and

(*b*) to recognize the saving to the trade in time, labour, expense and trouble when non-returnables are used by offering a slightly higher price over current market rates for eggs so packed."

Types of Non-returnables Recommended.—The Cornish case is the cheapest per 120 eggs, but, owing to its construction, damage to the contents is frequent, and the Committee were unable to recommend its general adoption. The preponderance of opinion in the trade is in favour of 30-dozen non-returnable cases fitted with fillers and flats, although a number of merchants favour the 60-dozen divisible case packed with wood-wool. Packing is said to be more rapid in fillers and flats than in wood-wool, but the difference, if any, is negligible when the packers are skilled. Under certain conditions, the use of wood-wool may, of course, be impracticable ; as, for example, when collectors are accustomed to pack for dispatch while on their rounds. The Committee, therefore, recommended the adoption of both types of non-returnable, *i.e.*, the 30-dozen and 60-dozen divisible cases, and the use of either fillers and flats or wood-wool at discretion ; they also recommend that only *new* cases should be used, and expressed the view that if a large number of representative packers of English eggs used *only* new cases, the remainder would have to fall into line.*

As the statutory specifications of the Irish 30-dozen and 60-dozen cases (*see* Appendix) are regarded as satisfactory by

* Attention is called to the fact that the railway companies will only accept eggs for conveyance at carriers' risk provided they are contained in substantial wooden boxes or cases, whether returnables or non-returnables, in which the eggs are efficiently and securely packed, and provided also that each egg is placed in a separate compartment and efficiently and securely packed therein. Eggs packed in the boxes recommended by the Committee would not comply with this requirement unless each egg were separately wrapped and placed securely in each compartment.

the trade, the Committee considered that they might be followed, with advantage, in this country, but with the reservation that the specification for the Irish 30-dozen case with fillers and flats is only suitable for eggs weighing $15\frac{1}{2}$ lb. per 120. The Committee therefore suggested that a special 30-dozen case should be used for 17-lb. eggs, of the same general specification as for the ordinary size, except that both compartments of the case should be $12\frac{1}{2}$ in. $\times 12\frac{1}{2}$ in. instead of $11\frac{5}{8}$ in. $\times 11\frac{5}{8}$ in., the depth being the same, *i.e.*, $13\frac{1}{2}$ in. in both instances. Machine-made fillers to hold 17-lb. eggs are available to fit this larger case, the dimensions of each compartment of the filler being $1\frac{7}{8}$ in. square and the filler being $12\frac{3}{4}$ in. over all. A case and fillers of these dimensions would also be suitable for duck eggs.

For cold storage purposes, an egg package should be well ventilated to prevent the absorption of odours by the eggs and to reduce mould growth. The 30-dozen case (Irish specification) recommended meets this requirement, and has, of course, the advantage of being suitable for transport. Although experience seems to show that the ordinary fillers are not unsuitable when used in the Irish type of 30-dozen case, special fillers for cold storage are available at little or no extra cost. Wood-wool is less suitable for cold store than fillers and flats, and straw packing is definitely unsuitable.

As already stated, no box-makers in Great Britain have, so far, quoted rates as low as those quoted in Ireland for boxes of the above standards (Fig. 4), although if the demand arose competition amongst box-makers in Great Britain would presumably lead to more favourable quotations. The lowest English quotations received were :—

	s.	d.
30-dozen case (including fillers and flats)	2	0
60-dozen case "in shooks"	2	9
60-dozen case "made up"	3	2

(These quotations are for large quantities.)

Interest attaches, therefore, to a fibre-board 30-dozen box, with wood frame ends, which is on the market and costs 2s. with fillers and flats (Fig. 5). Boxes of this type have the advantage that they pack flat when empty and are easily assembled. They are from 4 lb. to 5 lb. lighter than non-returnable wooden boxes of the same capacity and their use would, therefore, save something in transport charges.

Cartons.—In the questionnaire referred to on page 224, wholesalers were asked to express an opinion on the use of cartons in place of fillers and flats (Fig. 6). Replies showed that

while some merchants could see no reason why cartons should not be successful, the majority were opposed to the idea.

The advantage of the carton lies in its convenience as a consumer-package. It is popular in the domestic trade of the United States and Canada. A packing firm in Northern Ireland is now sending 30-dozen cases containing eggs in sealed cartons to consuming centres in the North of England, each egg being separately wrapped in soft packing paper and each carton containing a guarantee slip with the number of the packer and a request that complaints be notified to the address given. A few English packing firms also regularly supply eggs in cartons. The cost of a sufficient number of cartons to fill a 30-dozen case, in lieu of fillers and flats, amounts to 3s. (or $1\frac{1}{5}$d. per dozen eggs) for half-dozen cartons and a little over 2s. 1d. (or under $\frac{3}{4}$d. per dozen eggs) for cartons of the one-dozen size, or, say, 1d. and $\frac{1}{2}$d. more per dozen eggs respectively than new fillers and flats.

There are also objections to the use of cartons from the standpoint of the retail trade. There is the dislike of retailers to handling a branded article ; this could probably be got over, to some extent, if the name of the retailer were printed on the carton—a common trade practice as regards other commodities. There is also the objection—which in the present state of the home-egg trade is admittedly serious—that if, as would normally be intended, the cartons are sealed at the dispatching point, a retailer would be unable to examine the contents before sale. Finally, there is the question of expense, although experience shows that the additional cost of cartons is usually recovered in the improved prices which consumers are ready to pay for eggs so packed.

Notwithstanding the objections, the Committee considered that cartons would play an increasing part in the trade in home-produced eggs. No doubt, cartons could be used with advantage even now, particularly for a special grade of eggs, but the Committee look forward to the time when, in the areas of surplus production, more producers and country wholesalers would take in hand the organization of packing stations at convenient centres where eggs can be assembled in bulk, and tested, graded, packed and dispatched under a guarantee of quality to the centres of demand. Cartons, sealed at the time of packing, could then be used to bring the trade-mark of individual packing stations to the notice of consumers ; a brand on a 30-dozen case can never, of course, be effective in

the same way. If a group of neighbouring packing stations combined to use the same trade-mark, with the same implications of quality and reliability, then the exported produce of a whole area, say Suffolk, or Wiltshire, or Cornwall, would become identifiable on the market. Extending the idea a stage farther, if packing stations throughout the country used the same mark, then a national trade-mark would be created for home produce and national advertising becomes possible. The importance of this at the present time is obvious, but the effective use of cartons bearing an area or national trade-mark involves organization and a measure of voluntary control the details of which would have to be carefully worked out. Certainly, the possibilities of increasing consumption by the supply of high-grade eggs in attractive and convenient packages are, as yet, hardly explored. There is the further point that propaganda directed towards stimulating the consumption of home-produced eggs could be carried to the very homes of the people by means of slips of printed matter inserted in the cartons explaining the food value of eggs, giving recipes for their use and so on. This is a recent innovation in Canada.

(*b*) **Returnables.**—The Committee examined some 24 specimens of returnable egg boxes (Fig. 7), and made a number of criticisms and suggestions which have been communicated to the manufacturers concerned.

PACKAGES FOR DRESSED POULTRY.

The difficulty encountered in any attempt to compare the unit cost of different types of poultry packages, both returnable and non-returnable, is the fact that a container will hold different numbers according to the class of bird, *i.e.*, fowl, duck, goose or turkey, and the size packed. For the purpose of the inquiry it was, however, considered sufficient to compare the cost of the packages to the packer per lb. of poultry carried per journey when used for fowls. It was assumed that any decision as to the relative merits of returnables and non-returnables for poultry would have to be based on general principles rather than on specific instances. The question of the different weights of the various packages and their effect on the cost of transport and thus on the cost to the packer was excluded as introducing too many confusing factors.

The packages to be considered were peds, hampers, wooden boxes, chip or veneer boxes, cardboard boxes.

Peds and hampers, on account of their cost, are returnable ; wooden, chip and cardboard boxes can be manufactured at so

small a cost that their use as non-returnables is, *prima facie*, practicable.

(*a*) **Non-returnables.** *Comparative Costs.*—During the course of its investigation into the marketing of poultry, the Ministry obtained estimates from various firms for *wooden* boxes to hold one dozen fowls of the following weights per bird: 3 lb., 3½ lb., 4 lb., 5 lb. and 5½ lb. respectively. For assembled boxes, purchased in lots of 1,000, the lowest quotations were 8½d., 8¾d., 10d., 11d. and 1s. 0¾d. respectively, delivered London; this quotation was from a London firm. The same firm quoted for "sets" as follows: 6½d., 6¾d., 8d., 8¾d. and 10¾d. respectively. *Chip* or *veneer* boxes of the same capacities as the wooden boxes referred to above were quoted at 8½d., 9½d., 10¼d., 11d. and 1s. 1d. respectively, if purchased by the gross. Quotations for *cardboard* boxes of two kinds were received. The boxes are comparable with the wooden and chip boxes already referred to. The prices are 7d., 8d., 9d., 9½d. and 10d. and 4d., 4¼d., 5d., 5½d. and 6¼d. respectively The cheaper variety of cardboard boxes have wooden ends.

The following table compares the cost to the packer per lb. of poultry per journey of the three kinds of non-returnables :—

Boxes	Cost of package	Total weight of birds carried*	Cost to packer of package per lb. of poultry
Wooden (in sets)	d.	lb.	d.
1	6·5	36	·18
2	6·75	42	·16
3	8·0	48	·17
4	8·75	60	·15
5	10·75	66	·16
Wooden (assembled)			
1	8·5	36	·24
2	8·75	42	·21
3	10·0	48	·21
4	11·0	60	·18
5	12·75	66	·19
Chip or veneer			
1	8·5	36	·24
2	9·5	42	·22
3	10·25	48	·21
4	11·0	60	·18
5	13·0	66	·20
Cardboard			
1	7·0	36	·19
2	8·0	42	·19
3	9·0	48	·19
4	9·5	60	·16
5	10·0	66	·15

Cardboard with wooden ends			
1	4·0	36	·11
2	4·25	42	·10
3	5·0	48	·10
4	5·5	60	·09
5	6·25	66	·09

* One dozen per box.

From this it will be observed that the cost to the packer of packages of the non-returnable type is less than $\frac{1}{5}$d. per lb. of poultry carried.

(*b*) **Returnables.** *Ped* (Fig. 8).—A " ped " holding 24 birds weighing 4 lb. each costs 8s. 9d. and weighs 15-16 lb. It is usually supplied by the producer or fattener, who also bears the cost of the return journey. A " ped " is strongly made and capable of many journeys; taking into consideration losses and repairs, a fair estimate of the cost per journey is 2d., excluding transport. Peds are used exclusively for the trade in " Surreys " and are only found in the Heathfield district of Sussex. Of recent years the transport of poultry from that district has passed from the railway to motor-haulage contractors, who charge 1d. per bird per journey, including the return of the empty peds.

Hampers (Fig. 9).—Hampers are more widely used. There are many sizes of hamper, but, for the purpose of this Report, one holding 24 fowls of 4 lb. weight was taken; such a hamper weighs roughly 13 lb. and costs about 7s. 6d. The cost per journey, allowing a life of 50 journeys, would be about 2d. Hampers are still largely conveyed by rail. When empties are returned by special goods rate, the cost per cwt. for a journey of 50-100 miles is 1s. 2d., with a minimum charge of 8d. This means that, whereas eight empty hampers of the size and weight quoted above could be returned for 1s. 2d., or a little over 1½d. each, one empty hamper would cost 8d. Hampers are, however, usually returned two or three at a time, tied together, and an average cost per return journey for one empty hamper has been taken as 4d., which is possibly on the low side; an examination of a commission salesman's invoices shows charges for the return of single hampers ranging from 7d. to 1s. 6d.

For the purpose of comparison, the cost of returning a " ped " by rail was taken as the same as that for a hamper. On this basis, the cost of a " ped " or hamper per lb. of poultry carried per journey, assuming 24 birds weighing 4 lb. each are carried, works out at ·06d.

Comparative Cost of Returnables and Non-returnables.—The following table compares the cost per lb. of poultry per journey of non-returnables and returnables :—

	Cost per packer per lb. of poultry per journey* d.
Ped	·06
Hamper	·06
Wooden box (in sets)	·17
,, ,, (assembled)	·21
Chip or veneer box	·21
Cardboard box	·19
Cardboard with wooden ends	·10

* It has been assumed that the packer bears the cost of the return journey.

From these figures, it is evident that, whilst the non-returnable is roughly three times as expensive as the returnable, its cost compared with the value of the poultry carried is low and should be no obstacle to its introduction, if necessary, in the interests of the home industry.

Non-returnables Recommended in Principle.—Passing from finance to other aspects of the problem, it was noted that salesmen on the wholesale markets show less enthusiasm for the idea that non-returnables should be used for English poultry than was evidenced as regards eggs. Apart from one or two districts, supplies of English poultry arrive on the wholesale markets in ungraded lots packed in hampers or large boxes, from which the buyer selects the birds suited to his particular requirements. This selection may entail considerable handling, which causes a loss of " bloom " and depreciates value ; after the best buyers have taken their choice, the birds left over are sold at lower prices. Because of this loss of " bloom " and value, salesmen admit that the introduction of non-returnables would be a great advantage, but they fail to see how it would be practicable in the present state of the industry, when very few consignors of dressed poultry have sufficient birds available at any time to grade and pack in lots of one dozen closely graded birds which could be sold in the boxes as packed. The remedy of course lies with the industry itself, and it is suggested that conditioning and packing stations at which live birds could be assembled in large numbers from neighbouring farms and markets for conditioning, killing, plucking, dressing, grading and packing should be set up in areas of surplus production, either

by private enterprise or co-operatively. At these stations sufficient supplies would be handled to make uniform grading practicable, and, from the stations, the birds could be dispatched to the wholesale markets, neatly and effectively packed in one-dozen non-returnable boxes, bearing the brand of the station concerned. Suggestions as to the grades to be adopted have already been put forward by the Ministry* for the consideration of the industry.

Having regard, therefore, to the fact that imported poultry mostly arrives in non-returnable boxes holding one dozen birds, and is bought at sight, often without opening the boxes, certainly without handling the birds, the Committee had no hesitation in advocating the use of non-returnable packages whenever practicable for English supplies, although there may be comparatively few packers who can, as yet, use non-returnables to advantage.

The ped seems to serve its purpose for "Surrey" fowls in the Heathfield district, and will probably prove difficult to dislodge from its position. There is, however, no reason why wooden or chip boxes should not be substituted for the ped as the existing supply needs replacing. The number of birds of even size passing out of the hands of individual fatteners in the district affords an excellent opportunity for the introduction of standardized boxes in this part of England.

Types of Non-returnables Recommended.—As stated above, four types were available for consideration. The Committee rejected the cardboard containers on the ground that, if they got wet during transit, their appearance would prejudice sales and the contents might become tainted. On the other hand, the use of both chip and wooden boxes was recommended (Fig. 10). The chip container is pleasing to the eye and has important possibilities, especially for those who wish to give a distinctive appearance to their consignments.

The decision to recommend the use of chip and wooden boxes holding one dozen birds has been endorsed by salesmen on the wholesale markets of London and Manchester, and it is believed that the introduction of these packages would be favourably received throughout the country. The London Wholesale Poultry and Game Salesmen's Association recently passed the following resolution :—

> That this council is in favour of the use of non-returnable cases for the packing of home-produced poultry, recognizing saving of expense and trouble by the use of such cases, and is

* *Marketing of Poultry* (Economic Series, No. 11).

prepared to recommend the adoption of same to its members. The council gives preference to chip boxes.

These chip and wooden boxes would require to be made in sizes suitable for packing one dozen birds of weights varying from ½ lb. to 7 lb., in the case of fowls, and greater weights in the case of other poultry ; the Committee recommended that the Ministry of Agriculture and Fisheries should take the opportunity of ascertaining the approximate sizes required when more varied supplies of poultry are on the market than were available at the time of the Committee's inquiry.

The wooden boxes would require to be of the lightest possible construction compatible with strength, and to be prepared from low-priced material ; they should be made with spaces of about 1 in. between the boards on the top and bottom. The boxes would, as a rule, be put together by the poultry-keeper or merchant, who would buy the " sets " in bulk.

When naturally cooled poultry is packed in chip or wooden non-returnables, the birds should be wrapped in unglazed paper ; for chilled poultry the packages should be lined with straw or other insulating material. If the packing station idea develops, the paper used for the wrapping of each bird could bear the trade-mark of the packing station and, possibly, in due course an area trade-mark and a distinctive mark indicating British goods.

APPENDIX : NON-RETURNABLE EGG BOXES.

(1) 30-DOZEN (FILLERS AND FLATS.)

(To hold 360 eggs weighing 15½ lb. per 120.*)

Description.—The case should be made in two compartments, each compartment to take 180 eggs packed in fillers, with flats between the fillers. The wood should be well seasoned, clean, dry, and free from bark, wane, feather, large knots or pronounced odour.

Internal Dimensions			Timber Dimensions (To be not less than)				Fillers	
Each compartment			Top, bottom and side boards		End and centre boards		Each division to be	
Length	Width	Depth	Wide	Thick	Wide	Thick	Deep	Square
11⅝ in.	11⅝ in.	13½ in.	3 in.	¼ in.	3 in.	7/16 in.	2½ in.	1¾ in.

* For eggs weighing 17 lb. per 120 a case would be required of the same general dimensions as those set out for 15½-lb. eggs, but having each compartment 12½ in. square instead of 11⅝ in. ; the depth would be the same as the ordinary case, *i.e.*, 13½ in. Fillers with each compartment 1⅞ in. square would be necessary ; they should be 2½ in. deep and not exceed 12⅜ in. over all. These cases and fillers would be suitable for duck eggs.

Ends.—Each end should be not less than 13½ in. × 11⅝ in. × $\frac{7}{16}$ in. If made of two or more boards, the boards should be fixed upright; no end board should be less than 3 in. wide. The end boards should be nailed to cross battens measuring not less than 12½ in. × 2 in. × $\frac{7}{16}$ in., two on each end, fixed externally, one across the bottom of the end boards and the other as close to the tops of the end boards as the construction of the lid permits. The battens should be flush with the outer sides of the side boards.

Centre Division.—Each board should be not less than 13½ in. × 11⅝ in. × $\frac{7}{16}$ in. The division should be fixed in the centre of the case, secured by nails driven through the side and bottom boards.

Sides, Tops and Bottoms.—Each board should be not less than ¼ in. thick and not less than 3 in. wide.

Spacing.—The spacing between any two adjoining boards throughout the case should nowhere exceed ¾ in. When spacing is provided between any two side boards, it should be arranged so as to prevent any of the flats working through and the eggs coming in contact.

Nails and Nailing.—It is recommended that cement-coated wire nails be used; as far as possible nails should be driven askew the grain of the wood. Not less than two nails should be used in each end of each board, with an additional nad at each end of a board for every 3 in., or part of 3 in., by which the board exceeds 5 in. in width. The nails for making up this case should not be less than 1½ in. of 14 gauge.

Fillers.—The fillers should be of suitable material 2½ in. in depth; the extreme width of a filler should not exceed 11½ in. A flat of the same material should be placed between each filler, and a layer of corrugated paper or felt should be placed underneath each lowest, and above each uppermost, filler.

(2) 60-DOZEN (WOOD-WOOL).*

(To hold 720 eggs weighing not more than 17½ lb. per 120.)

Description.—The case should be made in two compartments. The ends and sides of the case should consist of two boards spaced horizontally; it should also have eight angle posts. The wood should be well seasoned, clean, dry, and free from bark, wane, feather, large knots or pronounced odour.

Internal Dimensions			Timber Dimensions (To be not less than)						
Each compartment			Top and bottom boards		Side boards		End and centre boards		Corner angle posts
Length	Width	Depth	Wide	Thick	Wide	Thick	Wide	Thick	
26 in.	23 in.	8 in.	4 in.	⅜ in.	3 in.	¾ in.	3 in.	⅝ in.	2 in. sq., cut diagonally†

* A 30-dozen (wood-wool) case would be of the same general dimensions as the 60-dozen, but would have only one compartment.

† Square-cut corner posts should not be used.

The spacing between any two adjoining top, bottom, side and end boards should nowhere exceed 1 in.; a saw space not exceeding ¼ in. should be provided between centre division boards.

Ends and Centre Divisions.—The case should have two centre divisions, each consisting of two boards; no board should be less than 23 in. × 3 in. × ⅝ in. If end boards of greater thickness than ⅝ in. are used, care should be taken to ensure that the internal length of each compartment is not less than 26 in.

Sides.—The side boards should be of the full outside length of the case, not less than 3 in. wide and ⅜ in. thick. They should be so fixed that the top edges of the upper boards, and the bottom edges of the lower boards, will be level with the top and bottom edges respectively of the end boards.

Tops and Bottoms.—Top and bottom boards should be not less than 4 in. wide and ⅜ in. thick. The outer edges of the outside top boards and bottom boards, when nailed on, should be flush with the outer sides of the side boards. The top and bottom boards should be of the full outside length of the case, and nailed into the end boards.

Nails and Nailing.—It is recommended that cement-coated wire nails be used; so far as possible nails should be driven askew the grain of the wood. They should be of sizes not less than the following: —

For nailing sides to ends and tops and bottoms to ends and centre division boards 2 in. and 1¾ in. nails respectively of 13 gauge;

For nailing corner posts to ends and sides to corner posts 1½ in. nails of 14 gauge.

Not less than two nails should be used in each end of each board, with an additional nail at each end of a board for every 3 in., or part of 3 in., by which the board exceeds 5 in. in width. This also applies to the nailing of the centre division boards. Each end of each side board should be secured by at least two nails driven into the end boards and at least one nail driven into the corner post. In nailing top and bottom boards to centre division boards, care should be exercised to place the nails in rows with at least ⅜ in. space between the rows so as to allow for the free working of a saw when the case is being divided.

Wood-wool.—Six pounds of wood-wool should be used for each 30 dozen eggs in a case; it should be evenly spread between each layer of eggs and at the bottom, top, sides, and ends of the case in sufficient thickness to prevent any layer of eggs moving in the ordinary course of transit. Only white wood-wool not less than ⅛ in. in calibre should be used.

N.B.—A list of box-makers who have signified their readiness to supply non-returnable egg and poultry packages of the dimensions recommended by the Committee can be obtained from the Ministry on application.

* * * * * *

HERBAGE SEED PRODUCTION IN NEW ZEALAND: I—WHITE CLOVER

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IN the arable-grass farming of New Zealand, the harvesting of seed crops takes a prominent place in the rotation; these crops, moreover, constitute a very important cash-producing commodity which adds materially to the earning capacity of the farm.

In addition to perennial rye-grass, crested dogstail, cocksfoot and red clover,* which have long been harvested in New Zealand, primarily for use in that country and for export to Australia and to Europe, in recent years, white clover, lucerne and, to a less extent, *Lotus hispidus* and *Lotus major* have become quite important seed crops.

Distribution.—It is only in comparatively recent years that white clover has been extensively used in the seeds mixtures employed in New Zealand. The seed would, however, have been introduced into the country in the earliest days, partially as an impurity in the rye-grasses and red clovers and other seeds, including cleanings and tailings, advisedly used by the earliest settlers, and later, of set purpose, in some of the mixtures. To-day, white clover has become firmly established over wide areas. It behaves in a precisely similar manner as in this country—just like an indigenous plant in fact. It occurs freely on many of the best pastures; it volunteers abundantly on the temporary leys and has made an unsown entry on to the native tussock grasslands, especially where these abut on tended grasslands and are grazed by animals having access now to the tended and now to the natural grasslands.

Seed Production in Relation to Habitat.—The white clover crop from which seed is harvested in New Zealand is almost invariably a volunteer crop, that is to say, the seed is not deliberately sown for the purpose of producing a saleable crop. Speaking broadly, the crop arises in one of three ways: (1) By excessive and immediate colonization on a wheat, barley, oat, or pea stubble; seed harvested from such a plant is known as "stubble white clover." (2) By colonization on a rye-grass-red clover ley, when by a third or fourth

* Chewing's fescue and brown top (*Agrostis vulgaris*) are also largely harvested in New Zealand; these two species are, however, chiefly exported for lawn purposes.

harvest year the ley may consist predominantly of white clover. A crop of seed may be taken as early as the fourth harvest year or, exceptionally, in the third harvest year, and, if leys are left standing, white clover may be harvested when the ley is anything up to, or even exceeding, 10 years old. (3) By colonization either on prepared grasslands that are left permanently to grass or on natural grasslands. Seed harvested from the former swards may be taken from fields that have been down to grass for upwards of 20 years and, in extreme cases, for upwards of 30 years; while from the latter the original colonization may have commenced five, 10, 20, or even more years ago.

Stubble White Clover.—Most of the stubble white is harvested in the Canterbury and Marlborough districts. In the latter district, the rapidity and completeness with which it dominates the stubble, after the corn harvest, is a remarkable and noteworthy phenomenon.

It would appear as if the seed does not germinate to any very considerable extent until the corn is harvested. The autumnal conditions are, however, very favourable to germination and establishment—so, in effect, this may be regarded as an autumn-sown crop from which seed is harvested in the following (= the first harvest) year.

The fields are usually shut up in October (spring) and a seed harvest is taken in December; it is not an unusual practice for the fields again to be shut up and a second crop of seed taken in March. Stubble crops have been known to yield as much as 600 lb. per acre, and 400 lb. is usually expected; a second crop will be about half of a first crop. The crop is cut with a reaper to which a metal follower is attached, from which a man rakes off the produce. This is immediately horse-raked into wind rows. The crop is normally not again handled, and may be carried within a week of cutting. If rain intervenes, the wind rows are lightly turned and, when sufficiently dried, the crop is carried.

The stubble crops are, usually, decidedly pure, being far freer from suckling clover than the sward crops, and yield seed of good colour and size and of high germinating capacity. After a crop has been harvested, and particularly if two crops have been harvested in the same year, the white clover usually gives place to suckling clover, a plant which has become even more strongly secondarily indigenous and aggressive in New Zealand than white clover itself. If, however, the land is top-dressed with superphosphate and well harrowed

immediately after the seed harvest, the white clover can be retained in good amount for a second harvest year, and this is a practice which is now adopted by some of the chief growers.

Temporary Ley White.—The crop is usually handled in a similar manner to the stubble crops, the seed being most generally harvested in the fourth to seventh harvest years. The yield may amount to about 330 lb. per acre. After a harvest, unless the ley is well top-dressed and harrowed as on the stubbles, the white clover tends to give place to suckling clover.

Old Sward White.—This is now not infrequently harvested with a stripper with special small chain beaters which "gather" the closely growing heads. Much of the seed off the older swards and the more natural grasslands, tends to be of a somewhat brown colour and not of attractive appearance, and this fact has undoubtedly reacted against the seed from the oldest swards contributing largely to the lots exported to this country. The value of seed from the older swards is, however, coming to be more generally realized in New Zealand, both for use in that country and for export; and considerable developments are to be anticipated in the direction of making greater use of this valuable source of supply of the best strains of white clover.

The average yield per acre of white clover, derived from all sources even for the most favoured districts, seldom exceeds about 250 lb., while it frequently does not exceed about 130 lb. for the country as a whole.

Marketing Practices.—In view of the fact that viability and purity are important characteristics of seeds, especially for export trade, it is not unnatural that bulking is largely adopted in New Zealand. It follows, since stubble white is usually a fine bold seed of high viability and relatively free from suckling clover, that this particular type very largely contributes to such consignments of white clover as are exported to this country. It is, of course, perfectly right and proper that suckling clover (which is cheap and of less value than white clover) should be regarded as a serious impurity in white clover. It is, however, to say the least of it, unfortunate, for reasons that will be emphasized in the next section, that this fact tends to favour stubble white and handicap sward white in connexion with the export trade to this country.

The white clover seed crop amounted to about 388 tons in 1922-23, and to about 218 tons in 1924-25. In 1925 about 32 tons were exported—in the proportion of about one-third to Australia and two-thirds to the United Kingdom; it is probable, however, that an appreciable amount of that reaching this country was re-exported.

Characteristics and Agricultural Usefulness.—An examination of old swards (10 years and upwards) in New Zealand indicates that much of the white clover approaches very closely in characteristics to the indigenous wild white of this country, although, on many pastures, the plants are not quite so dense and appear to be larger-leaved. Having regard to the mixed nature of white clover in respect of strain, and the effect of selective influences on restricting the types which colonize habitats, long-treated in any particular manner, this is, of course, what would be expected.* It would presumably be the more perennial and closer-growing strains which would persist on the older grasslands and, consequently, when white clover is harvested from the older leys and from the older swards in New Zealand, just as in this country, the seed would tend prominently to represent those strains which approximate in character most closely to the properties we have come to associate with the trade designation "Wild White Clover."

"Stubble" white, however, is harvested under conditions which tend inevitably to select the quicker-growing, shorter-lived strains. To "sow" in the autumn and to take a crop of seed the following year represents a very short period for establishment and growth, favourable only to the quick-growing strains. To take a second crop in the same year is further to select those strains which can pick up and grow very quickly—to select, that is to say, from a mixed population, types which predominantly consist of plants having, in the main, the characteristics which we have come to associate with "Commercial White Dutch."†

* It is significant in this connexion to observe that in samples of white Dutch clover, plants with the characters of wild white are frequently to be found, while in samples of the oldest sward wild white, plants with the characteristics of white Dutch are not infrequently met with. Adams in her studies on white clover has also remarked upon this phenomenon (see Adams, F. M. J., "Some Observations on White Clover." *Ann. App. Biol.*, Vol. XIII, 3, 1926)

† The truth of the above generalisation will be strikingly supported in a subsequent article dealing with perennial rye-grass, which in New Zealand is sown in the autumn in certain districts and in the spring

It has been realized in this country that much of the white clover emanating from New Zealand does, in fact, behave in a manner approximating far more closely to wild white clover than to white Dutch. The various commercial lots, however, behave very differently, an appreciable number giving results almost indistinguishable from those of ordinary commercial white Dutch.

Trials in Wales.—Trials conducted at the Welsh Plant Breeding Station are interesting in this connexion, for they give a measure of the degree of variability of New Zealand white clover, and afford material for estimating the value of the best New Zealand lots compared with genuine Kentish wild white.

Briefly stated, the results so far obtained are as follows :—

Trials, 1920-21.—Fourteen New Zealand lots were tested. A few of the lots gave drills nearly as dense as wild white. In most cases, the plants were rather more straggling and with larger leaves, and these in some cases were higher yielding than wild white. A few lots resembled very closely the Lodino white. The wild white and New Zealand lots gave the highest positive reaction to the cyanophoric test.

Trials, 1924-26.—Two New Zealand lots were tested in field plots against one commercial white Dutch, a wild white and a wild white once grown. The forage yields of white clover in lb. per acre for the two harvest years together were as follows :—

Wild white	Wild white once grown	White Dutch	New Zealand (1)	New Zealand (2)
2,890	2,890	1,410	2,660	1,630

At all stages, the once grown wild white was indistinguishable from the old sward wild white, while at all stages the white Dutch and New Zealand (2) were practically indistinguishable, neither plot giving a good sward of white clover. The New Zealand (1) made a dense sward, the plants, however, being somewhat larger-leaved than wild white and somewhat more lax. The productivity was at all times high.

Trials, 1926-27.—Four New Zealand lots, four wild whites and two white Dutch were sown in drills and in field plots

in other districts. All the researches in progress at Aberystwyth relative to "ecotypes" and "ecotypical" selection conclusively prove, moreover, that the longer-lived and persistent strains of all herbage species are those which grow slowly and "pick up" slowly.

in 1926. The density and amount of growth and size of leaves were estimated in April, 1927. The results were as follows :—

	Density Max. 10	Amount of growth Max. 10	Size of leaves
Wild white	8·9	4·5	Small
Commercial Dutch ..	1·5	1·5	Large
New Zealand	7·4	6·7	Intermediate

The New Zealand lots differed amongst themselves, one lot in particular having comparatively small leaves and, in every respect, more closely resembling wild white than did the other three lots. It is to be noted that the average results for the four lots resembled much more closely the behaviour of wild white than of commercial white Dutch.

Trials in New Zealand.—Mr. Deem, Agricultural Instructor for the Taranaki district, has experimented extensively with white clover, and the writer had the opportunity of examining some of his plots. At Waverley, a field had been sown eight years ago with a mixture including 3 lb. of Kentish wild white clover ; the sward was a remarkable one and a dense mat of clover. At Marton, Mr. Deem had large plots sown respectively with Kentish wild white, Kentish wild white once grown in the Marlborough district of New Zealand, old sward Canterbury white, and ordinary white Dutch. The poorness of the white Dutch was in marked contrast to the other three plots. There was no apparent difference between the "once grown" Kentish and that direct from Kent, but these two plots were probably slightly superior to Canterbury white, the difference, however, not being very striking or material. There was, however, a higher proportion of larger-leaved plants on the Canterbury plots than on the wild white plots.

Taking the evidence from the Welsh trials and from those of Mr. Deem together, it would appear that, for the formation of a dense and lasting sward, the genuine British wild white is a superior (and in Britain quite definitely superior) product to the best New Zealand white ; but that the best New Zealand white, although having larger leaves, does, in fact, approximate very appreciably to the more important characteristics of our genuine wild white clover. The Welsh trials also show conclusively that the poorest of the New Zealand lots reaching this country are in effect nothing but ordinary commercial white Dutch.

General Recommendations.—The evidence brought forward in this article shows that the state of affairs relative to New

Zealand white clover is less satisfactory than could be wished; this is the more unfortunate since a large proportion of the New Zealand harvest represents a product of the greatest possible usefulness.

It would be a great advantage if the New Zealand growers and exporters would categorize the seed and not blend "stubble" with sward lots. Those in this country who offer New Zealand white clover to the farmer—and those farmers who sow New Zealand seed are looking for the longer lived strains—are looking in fact for a seed which will, to some extent, take the place of wild white clover. This is obvious indeed from the price ruling for New Zealand white clover, which always stands considerably higher than ordinary White Dutch. It follows, therefore, that, as long as New Zealand clover is marketed merely as "Colonial" or New Zealand white, our importers should, as a precaution, and at all events until abundant evidence pointing in a contrary direction has been collected, insist on a guarantee that the seed is "sward" white and, of course, the older the sward the better. "Stubble white" may, of course, be presumed to have a value and a usefulness just for those purposes for which commercial white Dutch has a value and a usefulness, and in some cases may consist of a good proportion of relatively long-lived strains, but this seed coming on to our market without qualification, and at the same high price as old sward white, introduces a serious element of uncertainty, and tends to bring New Zealand white clover into disrepute with our farmers.

The whole position is intimately connected with suckling clover, for, as has been shown, it is the seed from the older swards (and therefore the most desirable seed) which contains the most suckling clover. The presence of suckling clover in fair amount is therefore an index of the desirability of a sample. It is unfortunate that the provision in the Seeds Act, demanding the declaration of suckling clover in white clover, has been largely misunderstood by practical men. There is no implication that suckling clover is an injurious weed seed, or that it is harmful—it is merely of less value than white clover and, as such, affects the legitimate price of the seed; consequently the purchaser in his own interests needs to be informed of the amount present. The amount should, however, be considered not only as such but as a valuable index of the reliability of the sample for sward formation.

The germination figure should also be considered in the

light of the fact that, generally speaking, old sward white clover is of a somewhat brown appearance and consequently has not such a good viability as stubble white or as ordinary White Dutch: reasonably good germination (upwards of 80 per cent.) should therefore be deemed quite satisfactory.

As matters stand at present, farmers purchasing New Zealand white clover usually do so entirely in the dark; they may be giving up to 6s. per lb. for an article only equal in value to White Dutch (about 2s.6d.) or they may be acquiring seed approximating more closely to the value (12s. 6d.) of wild white. Despite the results of tests, and the undoubted value of the best New Zealand white clover, it must be emphasized that disappointment will frequently follow the use of this seed. It is much to be desired therefore that those who are interested in the sale of this important and valuable product will take the necessary steps to put the marketing of the seed on a really satisfactory pedigree basis, supported by properly authenticated tests as to the genuineness and reliability of the strains. It cannot be assumed that all old sward white clover from New Zealand necessarily and always has the desired properties of persistency and longevity, and it is, therefore, important that seed collected from characteristic districts should be subjected, along with stubble white harvested under different conditions, to thorough test both in this country and in the Dominion.

Thanks are due to Captain Williams, M.Sc., and to Mr. Wm. Davies, M.Sc., for particulars and data relative to the Aberystwyth trials with white clover.

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CORRIEDALE SHEEP IN GREAT BRITAIN

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History and Description of the Corriedale Breed.—The idea of crosses between long-woolled sheep and Merinos was not new when the original experiments which led to the foundation of the Corriedale breed were conducted in New Zealand about 60 years ago. At first, there was considerable antipathy to the development of a type of sheep which would provide simultaneously good wool and good mutton, but it was soon recognized that there were distinct possibilities in the breeding of Romney Marsh-Merino cross-breds. In 1878, the flock, which had been founded about 10 years previously by selection of

breeding stock from this cross, was dispersed, but this and the following decades saw the beginning of a series of similar experiments involving the use of long-woolled breeds other than the Romney Marsh. The most popular breed was the Lincoln, but English Leicester, Border Leicester, and Romney Marsh rams were used on Merino ewes in some of the original flocks with the idea of reaching a type of sheep which would be hardy, would produce a heavy fleece of good wool, and, at the same time, provide a useful lamb for fattening purposes. Rigorous selection was practised in all the flocks, the succeeding generations being inbred, and only in some cases was blood introduced from crosses other than the original. A record of the experiments was begun in 1903, and in 1916 flocks were accepted for registration by the New Zealand Sheepbreeders' Association on the condition that the flocks should be the progeny of 15 years' continued inbreeding of the half-bred stock of Merinos and any pure breed of long-wool. The desired type has since been carefully selected and drastic culling enforced by inspection, with the result that a considerable uniformity of type has been attained.

The chief consideration has been the dual-purpose utility of the required type so that the general body conformation of Corriedale sheep to-day is essentially that of a typical mutton breed in that the shoulders and brisket are wide and deep, the ribs well sprung and filling up well behind the shoulders; a level back with a broad loin and the thighs deep with gigots of good form. The legs are straight, set square on the body, with good bone of moderate length; the head is broad, hornless, and carried on a well-developed neck. The fleece extends to cover the legs and to give a pronounced woolly topknot on the head; over the body the fleece is very dense and evenly distributed, yielding a large proportion of 56's wool. The crimp is very definite and even throughout the length of the staples.

Corriedales in Great Britain.—Corriedale sheep were shown in this country at the Wembley Exhibition, and at the close of the exhibition the two rams and three ewes, born in September-October, 1924, were acquired by Mr. James Piper, of The Grange, Burntisland, Fife, who was also negotiating for the shipment of a number of Corriedales to this country for the purpose of conducting experiments on wool improvement. These sheep, 10 rams and 20 ewes, born in September-October, 1925, were released from quarantine in the beginning of July, 1926, and the writer wishes to express here his most

grateful appreciation of the very complete facilities which are being afforded by Mr. Piper for the full observation of his flock by the Animal Breeding Research Department.

The Wembley Exhibition sheep were unshorn on their arrival in Fife in October, 1925, but were partially clipped then; the fleece was about 5½-6 in. in length, and, of this, about 4 in. were removed preparatory to placing the sheep under their winter conditions. It is the policy to test sheep under precisely similar conditions of management to those under which the commercial flock exists, but for about 10 days after this partial shearing the sheep were housed at night and afterwards allowed the free run of a small field, with the use of a shed if desired. Later, the sheep were on the hill, running up to 700 feet and much exposed. Extra food in the form of a few turnips was given. The winter was particularly bad with much changeable weather, and at one time the sheep had to be dug out of snowdrifts, but they stood the climate remarkably well.

The ewes were lambed down in a sheltered paddock, and the first lamb to be born, on April 5, 1926, was a pure Corriedale. This lamb was carefully examined and a photograph (Plate I) taken on April 15. A close study of the types of lambs' coats is important in all sheep-breeding work, and it was found that the pure Corriedale lamb possesses a dense, fine coat of great uniformity over the surface of the neck and body. Regularly disposed throughout the fine coat are numbers of coarser kempy fibres such as occur in the coats of the lambs of many breeds of sheep, and which may persist or may be completely shed as in the Merino. In the early stages of the lamb's post-natal existence, these fibres constitute a coat which is of great value in providing resistance to the weather, and, as such, are of considerable survival value and economic importance. These fibres increase markedly in relative numbers on the legs, and exist also on the head, but, while the general appearance, particularly of the legs, is hairy, the fine woolly undercoat which is in evidence later is well developed. In the Corriedale, this kempy protective coat is rapidly shed, leaving a dense, uniform fleece of excellent quality extending well over the head and legs. In all, three pure Corriedale lambs have been obtained from the three Corriedale ewes; these lambs are of an excellent type, well boned, standing square, with good shoulders and well-sprung ribs.

As yet, there has been no opportunity of examining closely Corriedale wool grown under natural conditions in this country.

FIG. 1.—Corriedale Ewe and lamb.

FIG. 2.—Corriedale and Cheviot lamb.

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FIG. 3.—Lincoln. 36s.

FIG. 4.—Merino. 66s.

„ 5.—Corriedale Lamb: 8 months fleece.

EXAMPLES OF STAPLES.

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The fleeces of the sheep exhibited at Wembley had been considerably mutilated by constant handling, and the sheep newly imported were subjected to much immersion by sea water during a stormy Channel passage, followed by 28 days' close confinement in quarantine; these latter sheep have, notwithstanding these unfavourable experiences, clipped fleeces of 5½ in. for about eight months' growth, and averaging 9 lb. for the rams and 9¼ lb. for the ewes. The wool is of good quality (New Zealand Corriedale fleeces contain a good proportion of 56's quality, ranging to 46's on the britch), very elastic, and the fleece is of great density throughout, the uniform compactness of the fleece being preserved by a regular network of binding fibres traversing the staples, together with an exceedingly regular crimp, which is well defined throughout the complete length of the staples. Plate II shows typical staples from the imported sheep compared with Lincoln and Merino staples.

When shorn, the sheep display their excellent mutton type, being squarely built and handling well; in the clipped condition, it can be seen that the fleece tends to split up along definite cleavage lines into irregular polygonal-shaped staples such as are typical of the Merino. This stapling is peculiar to very dense fine-woolled sheep and can serve as a useful indication of these characters.

Crosses with other Breeds.—The intention is primarily to examine the possibilities of the Corriedale as a pure breed, and, as such, the experiment here outlined is well worthy of serious attention and consideration by all sheepbreeders; but the rams were also allowed to run with a number of ewes of various sorts, and a description of the cross-bred lambs is of interest, particularly when it is realized that observation of the behaviour of pure breeds in crosses is of great use in assessing the value of the pure-bred itself so far as mutton-producing qualities are concerned.

The cross lambs were examined on June 25, 1926, being then on the average 6 to 8 weeks old; by the Corriedale ram 5 North Country Cheviot ewes had produced 6 lambs; 10 Border Leicester × Cheviot (half-bred) gimmers, 11 lambs; 1 Border Leicester × Cheviot ewe, 2 lambs; 5 Dorset Horn ewe lambs, 5 lambs; and 22 Border Leicester × Blackface ewes, 37 lambs. The lambs were all of good mutton type with well-developed gigots, and, while the Dorset Horn cross lambs appeared small owing to their being the offspring of ewe lambs, they were particularly promising as mutton sheep.

It is proposed to keep all the lambs until their first shearing, since the experiment is primarily concerned with wool characters.

In the Cheviot cross, there are distinct traces of the neck folds—a character of the Corriedale derived from the marked folds of the Merino. The fleece extends farther down the legs than in the pure Cheviot and a woolly forelock is more or less developed. All the lambs showed traces of the kempy outer coat still persisting, and while, in general, the individual coats were fairly uniform over the whole body, in some cases a distinct kempiness was noticeable, particularly in the lower thigh region. In these cases, the crimp was not at all well defined throughout the fleece, but, on the whole, a fine crimp appears typical of this cross, although the crimp is not so definite or regular as in either the Corriedale or the Cheviot. The natal spiral formation of the locks was distinct, the spirals being small and close, while, in general appearance, the coat showed certain indications of the peculiar Merino type of stapling to which reference has been made. Compared with the Corriedale × Cheviot cross, the half-bred cross lambs have a slightly better developed woolly forelock, a very uniform coat with fine wool well down the legs, and a typical Corriedale crimp.

The lambs from the Border Leicester × Blackface ewes by the Corriedale ram are interesting in that, while the coat is coarser than in the other crosses, with considerable hairiness on the thighs, there is a well-defined Merino type crimp throughout the uniformly dense coat. This crimp is particularly well marked on the shoulder, and there is distinct improvement on the normal Border Leicester × Blackface fleece.

The Dorset Horn cross lambs are the most interesting in many ways. On casual inspection, it is noticeable that the neck folds are here as well developed as in the pure Corriedale, if not more so, and the close, dense coat presents also the appearance of the Merino stapling. Since both these characters are peculiar to the Merino, it would appear that there is, in this cross, some considerable evidence in favour of the view, which has not been disproved by records, that there are traces of Merino blood in the present-day Dorset Horn breed. While the coat has a distinct similarity to that of typical Down lambs, the crimp is not well defined. The head and legs are well covered with fine wool; slight scurs were found on some of the lambs.

As judged by the lambs' coats, it would appear that the Corriedale can contribute towards improvement of wool characters ; the hardiness of the newly born lamb, as evidenced by the presence of the protective kempy coat, is not interfered with, since the Corriedale itself possesses traces of such a coat, and any tendency towards shedding this as the lamb grows—a desirable character of economic importance—is preserved. While in some cases, as in the Corriedale-Border Leicester × Blackface cross, there may be a reduction in amount and coarseness of this protective layer, such reduction would appear to be amply compensated for by the facts of increased density of the fleece and of well-marked natal spirals with a more definite crimp, resulting in a more compact coat, which is, in effect, a better protection against adverse climatic conditions than a longer and more open hairy coat.

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CHARACTERS WHICH DETERMINE THE ECONOMIC VALUE OF GRASSES

IV. PERSISTENCY AND AGGRESSIVENESS

(*Conclusion.*)

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WITH reference to all but the shortest duration leys, a fundamental property for a herbage grass is to be persistent and aggressive—to hold the ground well and to compete successfully against undesirable plants.

Persistency depends on the ability of individual plants to become long-lived perennials despite the influences of the environmental factors—biotic, soil and climate—as a whole. Aggressiveness implies an ability to spread and win more and more ground at the expense of other species.

Aggressiveness.—A plant can only be highly aggressive if it has either the power of spreading by the development of runners, root stocks or suckers, or of freely setting seed and developing established seedlings despite the methods of management. The great majority of our valuable herbage grasses are not creeping plants, consequently, in the case of most species, the individual plants are necessarily "spot bound." Within certain limits, however, "spot bound" plants can be aggressive, inasmuch as the area covered by each plant will be large in proportion to the amount of tillering. Plants, like perennial rye-grass and cocksfoot, may, however, be relatively aggressive compared with other plants if, as a

result of a higher persistency, they can withstand the conditions better, and hold their own against truly aggressive competitors.

Vegetative Aggressiveness.—Wild white clover is the outstanding example of a highly valuable pasture plant capable of winning ground by vegetative means—the development of runners. Many of the bent grasses and smooth-stalked meadow grass are aggressive by the same means. Unfortunately, however, in this country these latter species do not rank high as pasture plants. The same is true of the creeping red fescues. The strains of meadow foxtail vary considerably in their capacity for creeping, but even the best cannot compare with some of the bents in this respect.

Seeding Aggressiveness.—The extent to which pasture plants maintain themselves on the oldest permanent swards, by seeding and the production of seedlings, is an exceedingly important problem which has never received the critical study it deserves. That the great majority of plants are aggressive, at least to some extent, by this means can hardly be doubted. Critical herbage analyses, by the method of teasing out the plants from selected turves, frequently show the presence of a very considerable number of seedlings. Italian rye-grass, rough-stalked meadow grass, timothy (particularly in a cereal crop) and wild white clover, for example, are not infrequent arable land weeds, and following soon after sward afford evidence of seeding. The early unsown entry of wild white clover, rough-stalked meadow grass and crested dogstail, on swards in many districts, is again evidence of abundant seeding in a previous sward. That seedlings can establish themselves in very considerable quantities on swards is shown, for example, by the manner in which Yorkshire fog and yellow rattle become exceedingly aggressive on meadows which, year after year, are cut rather late for hay. Perhaps an almost better example is the annual yellow suckling clover which, in some districts, is an important element in the herbage even on comparatively dense swards. The aggressiveness of annual plants is purely a matter of ability to produce an abundance of seed, a fair proportion of which will develop seedlings.* Annuals, as aggressive pasture plants, assume very great importance in dry and relatively dry regions in Australia, where little clovers, with excellent seeding properties, like *Trifolium glomeratum*, *T. striatum*, and *T. tomentosum*, rank as very valuable herbage plants.

*Subterranean clover is the outstanding example of an aggressive annual—a plant which is endowed with particularly favourable seeding habits.

Under pasture conditions, seed can only be developed if some proportion of the flowering heads are either totally neglected or not grazed by stock until the seed is ripe. The seed may then be distributed by natural shedding or by passing through the animals. It is generally supposed that cattle are better seed distributors than sheep, though it is certain that seed can to some extent pass through sheep without losing its powers of germination. It is true that cattle are more prone to eat inflorescences than are sheep, so that sheep grazing favours natural shedding more than cattle. Sheep do not, however, entirely neglect inflorescences, and there is some evidence for thinking that they perhaps prefer flowering heads, bearing ripe seed, to immature heads. It is probable, too, that the establishment of naturally shed seed is more favoured on sheep than on cattle pastures, since, sheep being in greater number than cattle, the amount of trampling by the sheep must contribute very materially to the chances of seedlings, developed on the surface, obtaining a hold on the ground.

Crested dogstail is the outstanding example of a plant which is very largely allowed by stock to produce an abundant seed harvest, the seed heads being almost entirely neglected, and its aggressiveness on pastures must be attributed to this fact, accompanied by an ability for seedling establishment. The same is very largely the case with the bent grasses, the abundance of which is, probably, due as much to seeding aggressiveness as to anything else. Wild white clover is another plant which, to some extent at all events, is usually allowed to produce ripe seed, and its aggressiveness is probably as much due to natural shedding, and dispersal through cattle in particular, as to its powers of vegetative propagation.

A fair proportion of ripe seed spikes of perennial rye-grass, also, are usually to be found on old pastures. Speaking broadly, however, we know far too little as to the extent to which all kinds of stock graze inflorescences and at what precise stage of ripening these are taken.

Having regard to the fact that old pastures are, to some extent, reinforced by seedling establishment, it is somewhat remarkable that renovating mixtures on established swards are so seldom a real success. This may be due to the fact that much of the seed, naturally produced on pastures, would be over-ripe and "hard" before distribution and would, therefore, germinate over a very long period, thus affording

the seedlings the widest possible range of conditions for establishment.*

Seeds which have passed through animals would also be "sown" together with a medium in which to germinate and establish themselves, and would probably be more favourably placed than those broadcast in a renovating mixture. The possible importance of harrowing and rolling takes on a new aspect if seedling establishment is really an important factor in pasture management. The desirability of using a tined implement would, however, seem to be suggested, since this would do so much more to make for conditions favourable to establishment than merely the chain harrow.

In the management of range pastures in America, and that of much bush-burn country in New Zealand, "spelling" on a rotational basis of an adequate number of years, or allowing the grass to grow on and produce ripe seed at regular intervals, is recognized as an important means of maintenance.

"Spelling" has never been a general grassland practice in this country, but, as a possible method of rejuvenating old swards, it is worthy of experimentation—much of course depending upon the personnel of the sward and on the after-treatment. "Spelling" is obviously not incompatible with taking the mowers over pastures at about hay time to remove inflorescences and to maintain a leafy growth. From the point of view of seed production, a pasture would only need to be occasionally spelled and in a year favourable to seed production; that is to say, in a dry year (for example, such as 1911 or 1921) when a fair proportion of bare ground would result in the autumn and when the spelling, as such, would have largely militated against the effects of the drought.†

Persistency.—The persistency of grasses is influenced by a large number of factors. Bruce Levy,‡ in New Zealand, whose work on grasslands has added a great deal to our knowledge of the problem, recognizes the following as the more important factors: (1) soil fertility; (2) soil moisture content; (3) intensity of light and shade; (4) climate; (5) growth form

* "Hard" is here used rather in the sense of "dormancy." There is no doubt that, in general, seeds over-ripened are capable of longer periods of dormancy than seed under-ripe. This is known to be the case with crested dogstail, for example.

† See Stapledon, R. G., "Pasture Problems: Drought Resistance." *Journ. Agric. Science*, Vol. V, No. 2, 1912.

‡ Levy, E. Bruce, "The Grasslands of New Zealand: Preliminary Ecological Classification of Species." *N.Z. Journ. Agric.*, Vol. XXX No. 6, June, 1925.

of plant ; (6) seasonal growth of the plant ; (7) palatability of the plant. It follows that the persistency of plants can only be judged in relation to the sum effect of all the environmental factors. No single species of grass is therefore persistent or not persistent—each will be persistent under one set of conditions and short-lived and soon annihilated under another set of conditions. The recognition of this obvious fact is fundamental—a fact which has, however, been largely overlooked and probably in no respect more than in relation to soil fertility. Each species, Bruce Levy insists, has its very definite fertility requirements. It is of no avail to sow species with high fertility requirements on soils completely lacking in this respect. On a poor habitat, it is far better to have sheep's fescue, bent and Yorkshire fog than perennial rye-grass and cocksfoot. Having regard to the importance of leaf development, and presupposing proper management in relation to that leaf development, there is not the least doubt that, on a very poor soil, a sward, consisting of robust plants of bent and sheep's fescue and fairly robust plants of Yorkshire fog, would produce more leaf per acre per annum than starved and stunted plants of perennial rye-grass and cocksfoot. It is, therefore, of particular importance to recognize the fertility requirements of the different species : especially is this so in reference to the selection of long-duration seeds mixtures.

Bruce Levy's classification, in so far as a number of the grasses of importance in this country is concerned, is given in the table at the top of the next page.

His very low fertility class is chiefly filled by grasses of no application in this country, while he points out that, generally speaking, both annual grasses and annual clovers are associated mainly with the low and very low fertility classes.

If the classification is taken to apply to grazed pastures rather than to meadows, and this is what Bruce Levy has in mind in the main, the grasses would seem to behave in this country much as they do in New Zealand. Tall fescue has not, however, such high fertility requirements as the New Zealand classification suggests, while neither timothy nor meadow fescue acquit themselves well on soils of average fertility. Cocksfoot in this country could also be extended into the high-fertility class and perennial rye-grass into the extremely high-fertility class, while, with us, bent and sheep's fescue would be the most important grasses in the very low fertility class.

Name of pasture plant	Extremely high fertility	High fertility	Moderately high fertility	Average fertility	Moderately low fertility	Low fertility	Very low fertility
Meadow foxtail ..	+	+	+	—	—	—	—
Rough-stalked meadow grass	+	+	+	—	—	—	—
Tall fescue ..	+	+	+	—	—	—	—
Timothy	+	+	+	+	—	—	—
Italian rye-grass	+	+	+	+	—	—	—
Meadow fescue ..	—	+	+	+	—	—	—
Perennial rye-grass	—	+	+	+	—	—	—
Yorkshire fog ..	—	+	+	+	+	+	—
Cocksfoot ..	—	—	+	+	+	—	—
Crested dogstail..	—	—	+	+	+	—	—
Bent (*A. vulgaris*)	—	—	—	+	+	+	—
Heath grass (*Triodia decumbens*)	—	—	—	—	—	+	+

It follows that the ability of a grass to withstand adverse treatment, such as extra heavy grazing, will largely depend on whether it is satisfied as to fertility, soil moisture, climate and other environmental factors. A grass may survive moderately well if but one of a number of more or less essential factors are operating against it, while if several factors are so operating it cannot be expected long to survive.

This is well seen, for example, in the case of lucerne in the Marlborough district of New Zealand, where, on a soil ideal for lucerne production if aided by phosphatic manures and proper treatment, the crop is able to survive heavy and almost continuous winter grazing right into the crowns, an abuse which it could not tolerate under less favourable conditions. Equally, on soils of very high fertility, timothy may sometimes survive in considerable quantity as a pasture grass, while, on soils of even high fertility, it is seldom really abundant except on meadows.

It is well, however, again to insist that, because a plant does survive under the effect of some one adverse condition, by virtue of the extreme suitability of all other conditions, it is not to say that the plant is not lowered in aggregate productivity by the continued operation of the one unfavourable factor.

In so far as the light or shade requirements of the grasses are concerned, it must always be remembered that this is a

factor largely under control. Heavy and continuous grazing will tend to favour the light demanders or, at least, the light tolerators rather than the shade demanders, and, amongst the former, are undoubtedly to be classed relatively undesirable grasses like bent and sweet vernal grass.

Within limits, too, fertility is under control, and, as far as is economically possible, the endeavour should be, as Bruce Levy has said, to raise the fertility of our pasture-bearing lands up to the minimum standard demanded by thriving perennial rye-grass plants.

The effect of palatability on the extent to which grasses are defoliated, under pasture conditions, has already been referred to. In this connexion, it should be emphasized that in the case of all the more valuable grasses, with the exception of meadow foxtail and smooth-stalked meadow grass (if this is a really valuable grass), the "crowns" are situated at or above ground level.*

It has been pointed out, by Stapledon and Davies,† that early spring grazing, at a time when grasses are starting into growth, but before they have attained to really rapid development, has the most injurious effect on the earlier and more rapid-growing grasses. The bent grasses are late in starting and are neglected at this period, while, when they attain to a more critical stage, growth is so abundant that they are again largely neglected in favour of more palatable species.

This is a sequence of events which is largely responsible for the rapid spread of bent, especially on soils of a fertility class not sufficiently good to help perennial rye-grass, timothy and cocksfoot to stand up against the heavy differential grazing. Although bent is often fairly abundant, on Leicestershire and Romney Marsh fattening pastures, for example, it seldom, if ever, dominates such pastures. On these pastures, not only does the soil fertility tend to favour perennial rye-grass, but the best practice does not countenance heavy early spring grazing.

The influence of seasonal growth stage in relation to persistency is equally well exemplified by the behaviour of tall oat-grass on pastures. This is one of the earliest grasses to start growth in the spring. It is heavily grazed while in this succulent stage and, consequently, on pastures regularly

* There are indications, however, that the different strains of some of the more important species vary somewhat widely in this respect.

† See Stapledon, R. G., and Davies, Wm. Advisory Bull. No. 1. Univ. Coll. of Wales, Agric. Dept., Aberystwyth.

subjected to early spring grazing, it is a grass that is but seldom met with; indeed it is very quickly killed out of temporary leys subjected to this treatment.

To sum up then, it is evident that persistency is a matter very largely amenable to the control of the farmer. The biotic factor—the grazing animal—is or should be entirely under the farmer's control; the fertility factor is largely under his control; while in the formation of new pastures the selection of a seeds mixture, and the character of the after management, are subject absolutely to the will of the farmer.

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ELECTRICITY IN AGRICULTURE.—II

(Conclusion.)

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The Use of Energy.—The previous article dealt with the question of supply of electricity from the point of view of the supplier. His ideal, it was seen, is to deliver a maximum quantity of his product, to have the radius of his delivery as short as possible and to be able to spread the supply as evenly as possible over the whole twenty-four hours. We will now suppose that he has found his ideal, not fully, but sufficiently realized, and that we have a supply of energy awaiting us at the terminals on our own premises, to be used when required. Our immediate and ultimate object is to use this energy to our best advantage.

The electrification of the farm-house will probably be the first consideration. As its requirements in this respect differ in no material degree from those of any other dwelling-house, there is no need to go into the question here. But when it comes to electrifying the farm, two questions at once arise: how to set about it? is it going to make any difference in the existing methods of working? On the practical solution of the former question will depend the answer to be given to the latter.

If the substitution of electric for the older forms of power is to be successful, there must be kept in view, not only the question of cheaper running, which depends on the local cost of energy, but the other inherent characteristics of electrical operation, which lead, of course, to economies themselves. These are chiefly, flexibility, which permits of the

use of portable motors and apparatus, and of the arrangement of remote controls of machines and apparatus, cleanliness and silence of running, reliability and robustness, precision and efficiency. Any change-over to electric drive should be carried out with a view to taking the best advantage, eventual if not immediate, of each of these points.

The change need not necessarily be violent or drastic. If a farmer is building new premises or considerably altering his old, he can of course so dispose his machinery and equipment as to secure the best results from electrical operation. But we will suppose that the farm considered is already equipped with some form of engine, the usual line of shafting, and belt drive to the various machines—chaff-cutter, grinding machine, cake-breaker, etc.—such being the condition which is most usually found. It may not be desirable to undertake any considerable outlay in structural alterations or redisposition of the various machines. In this case, the obvious method will be to replace the engine by an electric motor.

Here it must be remembered that no form of engine or motor is perfectly efficient, using "efficient" in the technical sense. That is to say, that no form of engine or motor reproduces, as work done, the full amount of the energy put into it. But the electric motor, even under ordinary conditions, is a more efficient machine than its rivals, and, when care and thought are taken to secure what are, for it, the most favourable conditions, it may become a very efficient servant indeed, giving us back in work a maximum percentage of the units of energy for which we pay. We must now consider what these conditions are and how they are to be reproduced on the farm.

Suppose the existing barn machinery to consist of a grinding machine, requiring 5 h.p. to drive it, a chaff-cutter requiring 3 h.p., a cake-breaker requiring 2 h.p., all driven from a common line of shafting: suppose, too, that the shafting is continued through to the dairy to drive the appliances there, which take, say, 1 h.p. The heaviest single machine to be driven from the power system is the grinder, taking 5 h.p., so that the electric motor, which drives the shafting, must be at least of 5 h.p. rating. With such an arrangement it would not be possible to run any of the other machines while the grinding machine is running—this need not be a disadvantage—but it would be possible to run any two of the others simultaneously, as well as any of them singly.

The ordinary electric motor is now built to run at its

maximum efficiency, say 85 per cent., when it is working in the region of its full load, and the efficiency of working falls as the load is taken off.* That is to say, that the 5 h.p. will have its maximum efficiency when working at the rate of 5 h.p., but it will not be so efficient at 3 h.p., 2 h.p., or 1 h.p. In fact, when working at 1 h.p. rate (driving the dairy appliances alone), that is, at one-fifth of full load, the efficiency may be as low as 50 per cent. This latter figure means that, when working at the rate of 1 h.p., we are purchasing energy equivalent to working at the rate of 2 h.p.; thus the dairy work, when running alone, is costing more for power than it need. The same applies, in a modified degree, to the case in which the 3 h.p., or the 2 h.p., machine is working separately. It is seen that the one-motor system—or group-drive system—does not produce the most efficient results; in other words, it fails to secure minimum running costs and thus reduces the advantage to be obtained from the use of electrical power.

The ideal way, to get such results, is to fit each separate machine with a motor, suited to its own power and speed requirements, and independently controlled. Then each motor can run separately at its maximum efficiency and running costs will be at a minimum. The disadvantage of this lies in the increased first cost of the extra motors and equipment; consequently, the most usual method is to compromise between the two systems by having several arrangements of group-drive.

For instance, a 5 h.p. motor might be used as required to drive either the grinder or the chaff-cutter; a separate 1 h.p. motor might be permanently installed in the dairy for its sole use; a portable 2 h.p. motor could be used for driving the cake-breaker and any other similarly powered machines, root-cutters, circular saws, etc.

Existing installations on farms are carried out on lines similar to the systems here indicated, but there is another factor which may influence the future trend of equipping and running the farm electrically. As mentioned earlier, the type of load which the supply engineer prefers—and which he is often willing to give special tariff rates to encourage—is a steady load over a long period. If each individual farmer can develop such a load, he will eventually reap the benefit in the form of reduced tariff rates. This has a more direct appeal to consumers whose fixed charge is based, not on the

* What is here described is not peculiar to the electric motor. It is common to all forms of motive power.

rateable value of the premises, but, as in some cases, on their "maximum demand." The "maximum demand" of any consumer is the largest load (rate of using energy) which he puts on the system at any one time, irrespective of the total amount of energy he uses. In the example given, where the one 5 h.p. motor is used, the "maximum demand" would be 5 h.p., although the average demand might only be 2 or 3 h.p.

The size of the distribution and supply lines depends on the "maximum demand"—not on the total energy consumed—and thus it will pay both the supply company and, eventually, the consumer to keep down the "maximum demand," at the same time making the total consumption as high as possible. Since the total consumption is the product of the rate of working and the time during which this rate is maintained, the required condition is obtained by working at a low, steady rate over a long period.

This condition would be met by limiting the maximum power of any single machine to, say, 3 h.p. Where any one of the machines already in use on the farm is much larger, it would be advisable to substitute a smaller machine, but this would not necessarily require to be done at once, and the farmer would have time to feel his way and develop the new system gradually. The work which the older machine accomplished, say, in two hours, might take three or four hours with the new; thus, while the actual amount of energy consumed would be the same, the "maximum demand" would be reduced. It would be an easy matter to arrange that no more than one machine should be run at one time; the various operations would thus be successive and separate, and the work spread out over the day. Such operations as water pumping and low-rate water heating could be started up automatically after midnight, and automatically stopped before the day loads come on.

It may be objected that, unless this method of working is begun right away, the advantage is lost because the overhead lines will have already been erected to cope with the old "maximum demand." This objection would be valid enough if only immediate needs were to be considered. But there is future development to be thought of. If a certain number of farmers act as pioneers, gradually developing the method, and learning to operate it successfully, they will set an example for new consumers, who will be able to start off confidently on the right lines from the first. This will mean that the supply company will be able to serve many new consumers

without any alteration to the existing transmission lines. The financial burden of these lines will then be shared by the new consumers and, thus, the original consumers will benefit by a reduction of tariff.

The method outlined, of low "maximum demand," is, from the technical as well as the economic point of view, the ideal method of employing electrical power. Whether it is possible for the farmer so to plan his daily work as to adopt this method in its entirety is a question that can be solved only by extended experience on the part of such farmers, as are in a position to modify their present programme, for a period long enough to subject the new method to a thorough test.

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JUNE ON THE FARM

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Seasonal Notes.—June was "the dry month" of our Anglo-Saxon ancestors, and in most years it is characterized by abundance of sunshine, little effective rainfall and a tendency to dry and bake the soil. On the average of many years, June stands third in the order of dryness in the rainfall records of England and Wales, April and May having less rain. It is noteworthy, however, that the average figure for June (2·33 in.) is almost identical with that (2·34 in.) for February, which has the opposite reputation. Other old names for June, having agricultural significance, were Woed-monath, or weed month, and Braeck-monath, which probably refers to summer-fallowing operations.

Vegetative development is very rapid under the conditions of soil, light and temperature, typical of June. Pasture herbage grows faster than the normal number of cattle can consume it, with the result that some parts of the fields are allowed to run to seed while the cattle prefer to graze where the sward is shorter and more nutritious. Under the new system of pasture management, the excess produce of June is to be mown for winter fodder. In this month also, meadow grasses throw up their flower stalks; clovers, beans and peas come into bloom, and corn comes into ear towards the end of the month. Weeds are equally active in growth: those among root crops necessitate the constant use of the hoe, which may or may not be beneficial to the condition of the soil according to circumstances; but, generally, hoeing does good, apart from its effect on weeds, if carried out in June. Weeds among

corn crops at this stage are less easily attacked. Charlock in bloom may be very completely destroyed by spraying; docks and thistles may be pulled; but weeds of the grass species must for the most part be left till after harvest. As regards thistles, there is an old saying that "If you cut your thistles before St. John (June 24), you will have two in place of one," but this does not apply to pulling. Moreover, on pastures, several times cutting in the one season is the most effective method so far found for eradicating the common or creeping thistle.

Root Crops.—The singling of mangolds, sugar beet, and in northern districts, swedes, an occupation which absorbs much of the labourers' time in June, is commonly not begun early enough; but the emphasis which has recently been laid on this point, in connexion with sugar beet growing and the experimental results quoted for that purpose, has impressed on farmers the desirability of early spacing of the seedlings. Where it is necessary to choose between crops that are all requiring singling at the same time, probably priority should be given to that with the thickest braird, which would usually be sugar beet. Swedes, being capable of more rapid recovery than mangolds and sugar beet in the early stages after singling, may suffer less than mangolds from delay in thinning. Sometimes it is best to go over the crop rapidly at the first operation, leaving the plants in bunches, which may be thinned to single plants later. The actual singling is best done by hand; but, where the hoe is used, the surplus plants should be cut out without removing too much soil from the roots of the plant left. Sometimes the singled seedlings are so much exposed as to wilt and topple over after the operation. On the other hand experiments on hand versus hoe singling of swedes at Cockle Park in the years 1905-7 were, on the whole, slightly in favour of the hoe.

As regards the best width between drills and spacing in the rows, experiments with mangolds and swedes have shown that within reasonable limits, width of spacing has not a great effect on yield. With 24 inch drilling, there is little to be gained by leaving the plants closer than 10 inches apart in the rows. The spacing of sugar beet under British conditions is now under experiment, but the results of trials carried out at Garforth (Yorks.) last year may be mentioned. The trial was conducted in triplicate and the figures reported are averages of the three sets. As regards widths between drills on the flat, heavier yields of washed beet were obtained

from rows 24 in. apart than from rows 20 in. or 16 in. apart. It will be interesting to observe whether further trials confirm this result, but many growers in this country are of opinion that the close rows recommended on Continental experience are not, under British conditions, better than the widths ordinarily adopted for root crops. Possibly, however, closer rowing will be practicable when further light has been thrown on the effect of the horse hoe, particularly late horse hoeing.

As regards different spacings of the plants in the rows, as might be expected, the results varied according to the widths of the spaces between the rows. On the 24 in. spacing, the yield of washed sugar beet was 10·1 tons per acre with 8 in. singling, and 9·7 tons with 12 in. singling. On the 20 in. spacing, the best singling distance was 10 in., and on the 16 in. spacing the yield was best with 12 in. singling. Probably further experience and experiments will point out the desirability of varying the singling distance according to other circumstances. Ordinarily it is advisable to give more room to early sown plants on well prepared soils than could be made full use of by crops sown later and under less favourable soil conditions.

June is the ordinary month for sowing common turnips in the northern half of England, while swedes are not drilled before June in the midland and southern counties. In districts where swedes can be drilled in May without great risk of mildew, they are a more valuable crop than common turnips drilled a month later; but the softer turnips are better adapted for land that requires prolonged cleaning and working before it can be sown, as they are both deeper rooting and quicker in growth. On farms where the turnip crop is grown for feeding on the land with sheep, moreover, it is advisable to provide a succession of the different kinds of turnip, *viz.*, greystones for feeding first and yellows for consumption in November, before swedes are sufficiently ripe to be safely fed to sheep. Yellow turnips, owing to their abundant top growth, are a good cleaning crop and, in spite of their low content of dry matter, they favourably affect the yield of milk when thrown out to cows at pasture.

Haymaking.—The haymaking season begins with the trefoil crop, which, in the southern counties, is commonly cut before the end of May; rotation hay in the earlier districts commences to be mown about the middle of June, while farther north and in our upland districts, where grassland does not freshen until after the end of April, little grass is cut

until the beginning of July. In recent years, however, as a result of the emphasis that has been laid on the nutritive value of early-cut hay, and the general superiority of June as compared with July weather, there has been a notable tendency to start mowing at an earlier date. Early mowing is also a means of eradicating yellow rattle.

The case for an attempt to secure dry fodder of a nutritive value, similar to that of short leafy pasture grass, was advocated by the writer in an article in this JOURNAL in June, 1924; and research work carried out at Cambridge in 1925 and 1926 has shown that the dry matter of pasture grass has a protein content and starch equivalent nearly equal to that of a balanced dairy cake. Many farmers will, therefore, be interested in the attempt that is to be made to make grass cake by artificial drying, while some propose to test the possibility of drying and harvesting cuts of short leafy herbage by ordinary haymaking processes. Their chief difficulty will be that of getting the hay dry enough for safe stacking. Ensilage is another and perhaps more likely possibility.

As a rule midland farmers prefer to lead the hay direct from the windrow instead of putting it into cock; and the use of the hay loader is another consideration in favour of not cocking. On the other hand, when heavy morning dews, not to say rain, have to be encountered, the labour of heaping in the evening may be well repaid. Hay in large cocks develops sufficient warmth to keep out dew, and the carting of hay so heaped may begin perhaps two hours earlier in the day than is possible where it has been left in windrow over night.

Mowers.—The beginning of June may not be the proper time for overhauling mowing machines, but it is the time when many farmers remember to send their machines to the smithy. Unfortunately, many local smithies have closed down in recent years, and the overhauling and readjustment of farm machines is becoming more a matter for the implement dealer and for the farmer himself. In the case of the mowing machine, most of the troubles met with in the working of the mechanism may be traced to faults in the cutting parts; and the recognition of these faults may be a means of preventing others developing and, meanwhile, ensuring both better work and easier draught. Heavy draught, side draught, rapid dulling of the knife, refusal to cut close, and failure of the grass to fall over the knife as it should, are all indications of inefficient cutting parts.

The principle of the cutting mechanism is simple. The edge of the knife section is one side of a pair of shears and the edge of the finger plate is the other. Just as a pair of shears can cut only when its two edges are in actual contact, so it is essential that the knife section shall bear upon the finger plate. All the finger plates in the finger bar must be in correct alignment, which is often not the case, especially when new fingers have been inserted, or when a finger has been accidentally bent. The edges of the finger plate become worn and rounded, especially if allowed to corrode with rust during the winter. These edges must be filed to an angle. Sometimes also when a connecting rod has been broken, the new or repaired rod is slightly different in length from the original, with the result that the blade sections do not move from centre to centre of the fingers as they should. Another cause of this fault is the lag of the finger bar, due to wear at its hinges.

Warble Fly.—It is common knowledge that cattle are most troubled by the warble fly in hot sunny seasons,* and Dr. Walton of Bangor has shown that more warbles appear in the animals' backs after a relatively dry summer than after a season of high rainfall. Doubtless the warble pest does more damage in the drier and sunnier eastern counties than in the more humid western districts. The Bangor figures also show that absence of shade—as in upland districts—increases the risk of infestation. Three heifers on a hill farm were, in March, 1926, found to have 21, 65, and 48 warbles respectively, while another three were quite free from larvae; the latter group had grazed during the preceding summer in exceptionally shady and well watered fields in the lowlands, while the other three had become heavily infested by grazing on the open mountain slopes.

There is now ample evidence of the effectiveness of a number of dressings for killing the warbles; and the general adoption of warble destruction is much to be desired, but the individual farmer who wishes to protect his cattle from infestation may do so by walking them through a narrow bath of sheep dip, or otherwise dressing their heels and legs with a suitable insecticide. When the above suggestion was made in these notes two years ago, actual experimental evidence of the utility of this method was not available. Since then it has been tested and reported upon † as

* Walton, *Welsh Journal of Agriculture*, Vol. III.

† Innes, *Journal of Parasitology*, September, 1926.

undoubtedly preventing heavy infestation and as being both practical and economical for use on farms. The fluid used in the walking troughs was a 2 per cent. solution of coal tar creosote dip. This solution probably prevented infestation by repelling the fly, as other experiments have proved the effectiveness of a creosote spray for keeping flies off cattle. In the latter trials, one pint of tar oil to one gallon of waste engine oil was used. The fly does not confine itself to the heels, but lays also on the hind legs and the flanks, so that complete protection could not be ensured by the trough method alone.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending May 11				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½%) ..	13 15	13 15	13 5	13 12	17 7
„ „ Lime (N. 13%) ..	..	..	..	11 15†	18 1
Sulphate of ammonia :—					
Neutral (N. 20·6%)	12 6*	12 6*	12 6*	12 6*	11 11
Calcium cyanamide (N. 19%) ..	9 16*	9 16*	9 16*	9 16*	10 4
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 15	3 11
Potash salts (Pot. 30%)	4 17	..	..	4 10	3 0
„ (Pot. 20%)	3 12	3 2	3 9	3 2	3 1
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 7	3 6
Sulphate „ (Pot. 48-51½%)	11 10	10 5	10 16	11 5	4 5
Basic Slag (T.P. 32%)	..	..	..	3 11§	2 3
„ (T.P. 30%)	..	3 2§	3 1§	3 9§	2 4
„ (T.P. 28%)	..	2 11§	2 10§	..	..
„ (T.P. 26%)	..	2 7§	2 6§	..	..
„ (T.P. 24%)	..	2 2§	..	2 11§	2 2
Ground rock phosphate (T.P.58%)					
Very fine grade ¶	2 15	..	..	2 15*d*	0 11
Fine grade ‖	2 10	..	..	2 12*d*	0 11
Superphosphate (S.P. 35%) ..	3 9	..	3 12	3 7	1 11
„ (S.P. 33%) ..	..	..	3 9	..	..
„ (S.P. 30%) ..	3 2	2 15	3 5	3 2	2 1
Bone meal (N. 3¾%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	6 0†	6 5†	6 5	5 17	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Hull prices include delivery to any station in Yorkshire, Liverpool to any station in Lancashire. London prices are for 4-ton lots delivered in the home counties.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

NOTES ON FEEDING STUFFS FOR JUNE

E. T. HALNAN, M.A.,
Animal Nutrition Institute, Cambridge University.

The Composition and Digestibility of Maize.—Maize, either as a grain or in the form of a meal, is a common constituent of most animal dietaries. As is well known, many varieties of maize exist, these varying considerably in colour, shape and size. White, yellow, and purple varieties, and intermediate shades of these colours, are known, the chief varieties of the English markets being either white or yellow. In shape, two chief forms are recognized, these being round and flat. The chief maize-producing countries are America, Rumania, Hungary, Italy, Russia, Argentina, Mexico, and Africa. A considerable bulk of the maize imported into this country comes from America, Argentina, and Africa, and, in view of the differences in varieties and countries of origin, it becomes of interest to ascertain whether these differences in variety and origin are associated with differences in feeding value. Russia and South Africa chiefly produce white varieties of maize, and Argentina and America yellow varieties.

Work carried out in America with pigs, in connexion with which meal from yellow varieties of maize was tested against meal from white varieties of maize, gave a slightly more favourable result in the case of meal from the yellow varieties. In this test, the maize meal bulked largely in the ration, and the difference recorded was attributed to the higher vitamin content of the yellow meal, a difference that would vanish under conditions of English feeding practice, where the rations fed to pigs generally contain enough vitamins to satisfy growth requirements without considering the vitamin content of the maize meal included in the ration. In addition to this, yellow maize meal is disliked by bacon curers on the ground that the yellow maize meal tends to give rise to a yellow oily fat in the carcass.

This important question of differences in feeding value of different varieties of maize has received considerable attention in Germany, and facts of interest have emerged from this work. O. Hagemann, working on maize of African and American origin, showed that, not only is there little or no difference in the chemical composition of American and African maize, but that the digestibility coefficients are also

similar. The figures obtained by this worker, quoted below, bring this point out very clearly :—

	Composition of maize		Percentage digestibility	
	American per cent.	African per cent.	American per cent.	African per cent.
Moisture	12·68	12·68	—	—
Organic material ..	85·84	86·19	—	—
Crude protein	10·04	9·68	54·12	54·50
Crude fat	4·12	3·48	78·36	69·70
Sol. carbohydrate ..	68·76	70·94	85·15	86·16
Crude fibre	2·92	2·09	—	—
Ash	1·48	1·13	—	—

Feeding experiments, carried out with hens, also showed no difference between American and African maize so far as egg production was concerned.

Further experiments on the possible varietal differences in feeding value of maize have been carried out at Rostock research station by F. Honcamp, W. Schramm and H. Wiessmann. For the purpose of these experiments, two sheep were used, and the maize was supplied in a roughly ground condition, the experimental diet consisting of 500 g. meadow hay, 100 g. linseed cake and 200 g. maize. In this experiment yellow maize was tested against white maize. Calculated on the dry matter, the compositions of the two varieties were as follows :—

	White maize per cent.	Yellow maize per cent.
Organic material	98·83	98·45
Crude protein	10·23	10·95
True protein	10·11	10·40
Sol. carbohydrates	82·55	80·95
Crude fat	4·37	4·93
Crude fibre	1·68	1·62
Ash	1·17	1·55

It will be noticed that the chemical compositions of the two types of maize are practically identical. The digestibility coefficients obtained by these workers were as follows :—

	Percentage digestibility	
	White maize	Yellow maize
Organic material	81·2	83·8
Crude protein	39·0	56·4
Sol. carbohydrates	87·5	88·8
Crude fat	63·0	77·2

Fair agreement is shown between these figures obtained with yellow and white varieties of maize and those previously obtained by O. Hagemann for American and African varieties, particularly as regards the chief constituent, the starch or soluble carbohydrates. On the basis of the above figures, the

starch equivalent of white maize works out at 81·47, and that of yellow maize 85·13, and the conclusion is reached that there is practically no difference in feeding value between white and yellow maize. Taken in conjunction with O. Hagemann's work, we are led to the conclusion that, on a dry matter basis, all maize is similar in feeding value from a farm value standpoint.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	10 10
Maize	81	6·8	8 2
Decorticated ground nut cake	73	41·0	11 5
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage)

The cost per unit starch equivalent works out at 2·48 shillings, and per unit protein equivalent, 1·17 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 10
Oats	60	7·6	7 18
Barley	71	6·2	9 3
Potatoes	18	0·6	2 5
Swedes	7	0·7	0 18
Mangolds	7	0·4	0 18
Beans	66	20·0	9 7
Good meadow hay	31	4·6	4 2
Good oat straw	17	0·9	2 3
Good clover hay	32	7·0	4 8
Vetch and oat silage	13	1·6	1 14
Barley straw	19	0·7	2 8
Wheat straw	11	0·1	1 7
Bean straw	19	1·7	2 9

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	12 7	0 15	11 12	72	3 3	1·74	9·6
Barley, British feeding	—	—	10 10	0 12	9 18	71	2 9	1·47	6·2
„ Canadian No. 3 Western	40 0	400	11 3	0 12	10 11	71	3 0	1·61	6·2
„ Persian	35 0	„	9 17	0 12	9 5	71	2 7	1·38	6·2
Oats, English, white	—	—	9 13	0 13	9 0	60	3 0·	1·61	7·6
„ „ black and grey	—	—	9 7	0 13	8 14	60	2 11	1·56	7·6
„ Scotch white	—	—	10 13	0 13	10 0	60	3 4	1·78	7·6
„ Canadian feeding	26 9	320	9 7*	0 13	8 14	60	2 11	1·56	7·6
„ American	23 9	„	8 7†	0 13	7 14	60	2 7	1·38	7·6
„ Argentine	27 3	„	9 10	0 13	8 17	60	2 11	1·56	7·6
„ Chilian	27 9	„	9 15	0 13	9 2	60	3 0	1·61	7·6
Maize, Argentine	34 6	480	8 2	0 12	7 10	81	1 10	0·98	6·8
Beans, English winter	—	—	10 10	1 10	9 0	66	2 9	1·47	20
Peas, Japanese	—	—	22 10‖	1 6	21 4	69	6 1	3·26	18
Dari, Egyptian	—	—	11 5	0 14	10 11	74	2 10	1·52	7·2
„ Persian	—	—	10 15	0 14	10 1	74	2 9	1·47	7·2
Millers' offals—									
Bran, British	—	—	7 10	1 6	6 4	42	2 11	1·56	10
„ broad	—	—	8 7	1 6	7 1	42	3 4	1·78	10
Middlings, fine, imported	—	—	9 17	1 1	8 16	69	2 7	1·38	12
„ coarse, British	—	—	8 10	1 1	7 9	58	2 7	1·38	11
Pollards, imported	—	—	7 10	1 6	6 4	60	2 1	1·12	11
Meal, barley	—	—	11 0	0 12	10 8	71	2 11	1·56	6·2
„ maize	—	—	9 7	0 12	8 15	81	2 2	1·16	6·8
„ „ germ	—	—	8 15	0 18	7 17	85	1 10	0·98	10
„ „ gluten feed	—	—	8 15	1 5	7 10	76	2 0	1·07	19
„ locust bean	—	—	8 10	0 11	7 19	71	2 3	1·20	3·6
„ bean	—	—	12 0	1 10	10 10	66	3 2	1·70	20
„ fish	—	—	20 10	4 1	16 9	53	6 3	3·35	48
Maize, cooked flaked	—	—	9 17	0 12	9 5	85	2 2	1·16	8·6
Oilcakes—									
Linseed	—	—	18 0	1 9	16 11	119	2 9	1·47	19
„ cake, English 12% oil	—	—	11 15	1 16	9 19	74	2 8	1·43	25
„ „ „ 10% „	—	—	11 7	1 16	9 11	74	2 7	1·38	25
„ „ „ 9% „	—	—	11 2	1 16	9 6	74	2 6	1·34	25
Soya bean „ „ 6% „	—	—	11 5*	2 11	8 14	69	2 6	1·34	36
Cottonseed „ „ 5½% „	—	—	6 5	1 13	4 12	42	2 2	1·16	17
„ „ Egyptian, 5½% „	—	—	6 0	1 13	4 7	42	2 1	1·12	17
Decorticated cottonseed meal, 7% oil	—	—	10 0	2 11	7 9	74	2 0	1·07	35
Coconut cake, 6% oil	—	—	9 0	1 9	7 11	79	1 11	1·03	16
Ground-nut cake, 6-7% oil	—	—	8 15*	1 14	7 1	57	2 6	1·34	27
Decorticated ground-nut cake, 7% oil	—	—	11 5*	2 12	8 13	73	2 4	1·25	41
Palm kernel cake, 6% oil	—	—	8 10	1 2	7 8	75	2 0	1·07	17
„ „ „ meal, 6% oil	—	—	9 0*	1 2	7 18	75	2 1	1·12	17
„ „ meal 2% oil	—	—	7 17	1 3	6 14	71	1 11	1·03	17
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1·20	2·7
Brewers' grains, Dried ale	—	—	6 17	1 2	5 15	49	2 4	1·25	13
„ „ „ porter	—	—	6 7	1 2	5 5	49	2 2	1·16	13
„ „ Wet ale	—	—	0 16	0 8	0 8	15	0 6	0·27	4·8
„ „ „ porter	—	—	0 11	0 8	0 3	15	0 2	0·09	4·8
Malt culms	—	—	6 5	1 12	4 13	43	2 2	1·16	16

Prices at London except where otherwise stated.

* At Hull. † At Bristol. ‖ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of April and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is £1 2s. per ton. The food value per ton is therefore £8 18s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 12s. 0d. P_2O_5, 3s. 10d.; K_2O, 3s. 0d.

MISCELLANEOUS NOTES

Agricultural Meteorological Conferences

ONE of the most interesting features in the Ministry's Agricultural Meteorological Scheme is the series of annual Conferences at which those engaged on the study of various aspects of the work discuss the results of their investigations. At the Conference held last year, a full report on which has just been issued, the following papers were read :—

The Influence of Summer Rainfall on the Fruiting of Apples (Mr. A. H. Lees, Long Ashton Research Station). *Meteorological Conditions and the Growth of Barley* (Dr. F. G. Gregory, Plant Physiology Research Institute, Imperial College of Science) *Essentials of Theory and Points of Practice in Crop Weather Work* (Mr. L. F. Engledow, Cambridge Plant Breeding Institute). *Technique of Crop Observations* (Mr. T. Eden, Rothamsted Experimental Station). *Solar Radiation* (Mr. R. Corless, Meteorological Office). *The Effect of Solar Radiation on Plant Growth* (Professor V. H. Blackman, Plant Physiology Research Institute, Imperial College of Science). *The Value of Co-ordination in Phenological Observations* (Mr. J. E. Clark, Royal Meteorological Society). *The Value of Phenological Observations in Practical Agriculture* (Mr. A. Roebuck, Midland Agricultural and Dairy College).

A limited number of copies of the report may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

The papers which will be read at the Conference arranged for September 22 and 23 of the present year are as follows :—

The Week as a Phenological Unit (Sir W. Napier Shaw).

The Effect of Climate on the Growth of Vegetables (Mr. M. C. Vyvyan, Cambridge Horticultural Research Station).

The Effects of Temperature and Humidity on the Changes in Weight of Crops in Storage (Mr. H. J. Page, Rothamsted Experimental Station).

The Effect of Temperature on the Keeping Quality and Bacterial Content of Milk (Mr. H. Barkworth, South-Eastern Agricultural College).

Rothamsted Temperature Records (Mr. T. N. Hoblyn, Rothamsted Experimental Station).

The Effect of Meteorological Conditions on the Amount and Nutritive Value of Pasture and Hay. (Professor R. G. Stapledon, or a member of the staff of the Welsh Plant Breeding Station).

The Effect of Meteorological Conditions on the Rate of Growth of Pasture Grass (Dr. H. E. Woodman, Cambridge Animal Nutrition Institute).

Temperature and the Food Requirements of Animals (Professor T. B. Wood, Cambridge Animal Nutrition Institute).

The Effect of Ultra-Violet Light on Animal Nutrition (Dr. J. B. Orr, or a member of the staff of the Rowett Research Institute).

Meteorological Factors affecting Sheep (Mr. J. E. Nichols, Animal Breeding Research Department, University of Edinburgh).

The Conference will be open to all those interested in agricultural meteorology.

Those who desire to attend should notify the Secretary, Agricultural Meteorological Committee, Ministry of Agriculture, 10 Whitehall Place, London, S.W. 1.

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Clean Milk Courses for Sanitary Inspectors

AN account of the introduction of the scheme for providing short courses on clean milk production at Agricultural Colleges, for the special benefit of Sanitary Inspectors, appeared in this JOURNAL for April, 1926. Since then the scheme has made considerable progress, and this further account may, therefore, be of interest.

It will be recalled that the courses aim at bringing to the notice of Sanitary Inspectors, in as short a time as possible, the main points concerned in the production and handling of milk on up-to-date lines, in the light of the most recent knowledge. The scheme was introduced by the Ministry in conjunction with Agricultural Colleges, after the matter had been discussed and cordially approved by the Sanitary Inspectors' Association. Nearly all the provincial Agricultural Colleges have provided, or are prepared to provide, special courses of this nature, the syllabus being based generally on a scheme prepared and issued by the Ministry in conjunction with the National Institute for Research in Dairying, Reading. In addition to lectures and demonstrations on various aspects of clean milk production, the courses usually include visits to typical dairy farms, bottling establishments, etc.; they may last for four or five days, or be held on one or more days or evenings a week for a number of weeks. A fee, sufficient to cover the cost of the course, is charged by the College and is normally in the neighbourhood of £2. The Inspectors must, of course, provide their own accommodation and travelling expenses.

The following statement shows the courses which have been held to date, and the attendance at each :—

Centre	Attendance	Duration
Leeds University	16	Eight days
	15	Nine consecutive Thursday evenings
	14	Eight days
	25	Nine consecutive Monday evenings
Reading Dairy Research Institute	15	Five days
	14	Five days
	17	Four days
University College, Bangor	13	Six days
	12	Four days
Bristol University	12	Two weeks : afternoons only
	14	Two weeks : evenings only
Seale Hayne College	11	Five days
	18	Four days
Armstrong College	41	Eight consecutive Fridays
	17	Six consecutive Fridays
University College, Aberystwyth	21	Five days
Midland College	12	Six days
	3	Five days
Harper Adams College	6	Five days
Wye College	8	Six days
	15	Five days
Manchester University	138	Seven consecutive Thursdays
East Anglian Agricultural Institute	24	Eight days
Moulton Farm Institute	12	Seven Thursdays
Rodbaston Farm Institute	25	Six consecutive Friday afternoons
Reaseheath Farm Institute	8	Three days
Total attendance	526	

Although the scheme is only of recent introduction, its value is already generally recognized, and there is little doubt that, as time goes on, it will do much to foster the spirit of co-operation between those who are concerned with what may be termed the educational and control aspects of clean milk production. The Milk and Dairies Order of 1926, which superseded then existing regulations governing the production of milk, reflects the view, which is now generally held, that methods of production are of at least equal importance with the provision of satisfactory milking and handling accommodation. It is all to the good, therefore, that facilities have now been provided in most parts of the country whereby the officials who are concerned with the administration of the

Order may keep in close touch with the most up-to-date knowledge on the question of clean milk production, and may be brought into association with those who are interested in helping producers to improve their methods. The value of co-operation between educational officers and local control officials was emphasized by the Ministry of Health in the circular letter (No. 757) dated January 20, 1927, issued to Local Authorities on the subject of the Milk and Dairies Order, 1926. Incidentally, this letter commended the clean milk courses for Sanitary Inspectors to the notice of Sanitary Authorities, and stated that such Authorities might, in the opinion of the Minister, legally incur the reasonable expenditure involved by the attendance of Inspectors at the courses.

As an illustration of the value of the courses to the Sanitary Inspectors who attend them, the following extract may be quoted from a report* by a Sanitary Inspector who attended a recent course at Reading :—

> "The knowledge that is imparted in these lectures is of such interest and so clearly given that I feel confident no one attending them can fail to be greatly benefited thereby, and I am more than ever convinced that it is of paramount importance that all inspectors, whether engaged in questions of milk supply or not, should be given an opportunity of attending future courses. . . . I repeat that no finer opportunity has been given to the public health service than the opportunity to attend the courses of lectures at Shinfield."

In conclusion, it may be said that, should Sanitary Inspectors in any area find it difficult to attend a course at the nearest Provincial College, the Ministry will be glad to endeavour to arrange a course at a Farm Institute or some other centre more easily accessible. A few such decentralized courses have already been held, and others are in course of preparation.

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Fream Memorial Prize

THE Fream Memorial Prize, which is annually awarded by the Ministry to the candidate who obtains the highest marks in the examination for the National Diploma in Agriculture, has been won this year by Mr. Cecil E. Elms, a student of the Seale-Hayne Agricultural College and Reading University. The value of the prize this year is about £7, which is to be devoted to the purchase of books.

* The *Sanitary Journal*, April, 1927 : Clean Milk Course—Shinfield, near Reading, February 15-18, 1927.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended March, 1927, compared with the corresponding period in 1926. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	January to March, 1927		January to March, 1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	168	72,808	136	23,130
Brazil	0	0	8	1,800
Canary Islands	0	0	23	475
Chile	0	0	30	2,670
Denmark	9	344	1	120
Uruguay	32	7,026	31	7,436
Australia	0	0	35	6,421
British India	7	730	6	350
Falkland Islands	0	0	10	361
Irish Free State	1,250	29,416	1,663	30,363
Kenya	8	389	5	300
Union of South Africa	0	0	7	350
Other countries	10	1,007	10	1,147
Total of Cattle	1,484	111,720	1,965	74,923
SHEEP AND LAMBS				
Argentina	310	6,571	141	4,135
Brazil	4	210	3	52
France	14	43	0	0
Peru	30	360	0	0
Switzerland	0	0	8	120
Uruguay	20	600	11	147
Australia	0	0	2	367
Irish Free State	79	248	121	310
Other countries	2	83	4	65
Total of Sheep and Lambs	459	8,115	290	5,196
SWINE				
Argentina	4	160	2	65
Belgium	0	0	6	240
France	2	73	15	342
Germany	9	405	3	70
Italy	3	150	0	0
Russia	0	0	180	3,646
Serb-Croat-Slovene State	0	0	40	1,250
Irish Free State	264	1,414	155	810
Other countries	6	188	4	87
Total of Swine	288	2,390	405	6,510

The Agricultural Index Number

THE general level of the prices of agricultural produce was maintained in April at the same figure as in the previous month. On the average, prices were 43 per cent. above those in the corresponding month of 1911-13, as compared with 52 per cent. in April, 1926. The seasonal downward movements in the prices of milk, eggs, and butter continued on normal lines. Cattle and sheep prices improved slightly, while pigs were inclined to cheapen.

In the following table are shown the percentage increases, as compared with pre-war prices, each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	—
June	64	49	56	53	48	—
July	67	50	53	49	48	—
August	68	52	57	54	49	—
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.

Wheat averaged 11s. 6d. and barley 10s. 10d. per cwt., the former being 2d. and the latter 1d. per cwt. cheaper than in March, but, whereas the index figure for wheat declined 5 points to 52 per cent. above pre-war, the relatively greater fall in the price of barley in the corresponding period of the base years caused the index figure for this commodity to rise 3 points. Oats appreciated in price by 3d. per cwt. to 8s. 4d. per cwt., and the index figure was 4 points higher at 18 per cent. above 1911-13. As compared with prices a year ago, wheat was 5d. and oats were 7d. per cwt. cheaper, but barley was 1s. 9d. per cwt. dearer.

Live Stock.

After falling for several months, the prices of fat cattle rose slightly in April, but the increase was relatively rather less than in the base years, and the index figure declined by 1 point to only 25 per cent. above pre-war, as against 39 per cent. a year ago. Dairy cows and store cattle also continued at low prices, though they were slightly higher on the month, the index

figures being 26 and 23 per cent. respectively above 1911-13. Fat sheep were dearer than in March, an increase of ¼d. per lb. estimated dressed carcass weight being recorded, and the index figure rose by 8 points to 53 per cent. above pre-war. Part of this rise is attributable to a reduced base price in April, 1911-13. All descriptions of pigs fell away a little from recent high levels, and fat pigs are now at about the same price as in April, 1925, porkers being rather dearer, and baconers rather cheaper than two years ago. Store pigs remain comparatively dear at 108 per cent. above pre-war, as compared with 55 per cent. in the corresponding month of 1925.

Dairy and Poultry Produce.

Egg prices were fairly constant throughout April, but the average was about 1½d. per dozen lower than in the previous month, and, as this reduction was rather sharper than in the corresponding period of the base years, the index figure declined by 2 points to 37 per cent. above 1911-13. At this level, eggs are cheaper than they have been since April, 1923. Milk sold at summer prices in April this year, but, although the average contract price was lower than in March, the index figure for milk shows a rise of 7 points to 63 per cent. above pre-war. This is accounted for by the fact that the transition from winter to summer prices was more abrupt in the base years. Butter showed the usual seasonal decline, and was 1d. per lb. cheaper on the month, but, as this decrease was not relatively so great as in the corresponding period of the base years, the index figure was a little higher at 43 per cent. above pre-war. The price and index figure for cheese remained unaltered, being only 36 per cent. above 1911-13. Poultry, on the whole, were cheaper than at this period in 1926.

Other Commodities.

On average the prices of potatoes have shown little variation from those ruling in March, but, as there was a considerable rise in April, 1911-13, the index number is reduced from 85 to 60 per cent. above the level of the base years. At this level, however, potatoes were much dearer than a year ago, when they were selling at only 7 per cent. above pre-war prices. Vegetables were decidedly cheaper during April, and sold at prices averaging about 19 per cent. more than in 1911-13, as compared with 37 per cent. in March. Hay was unchanged in price, but wool was a little dearer, and the index figure was one point higher at 34 per cent. above pre-war.

Index numbers of different commodities, during recent months, and in April, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	Apr.	Apr.	Jan.	Feb.	Mar.	Apr.
Wheat	62	57	61	60	57	52
Barley	38	18	36	37	38	41
Oats	34	26	20	16	14	18
Fat cattle	50	39	33	30	26	25
Fat sheep	100	59	57	44	45	53
Bacon pigs	68	82	70	63	63	61
Pork pigs	67	84	82	75	76	73
Dairy cows	47	39	28	26	25	26
Store cattle	39	31	29	30	27	23
Store sheep	100	60	55	48	41	40
Store pigs	55	119	135	125	116	108
Eggs	51	48	46	62	39	37
Poultry	50	46	38	39	34	25
Milk	58	95	65	62	56	63
Butter	64	49	37	40	40	43
Cheese	61	77	38	36	36	36
Potatoes	115	7	95	94	85	60
Hay	− 2*	5	− 1*	− 2*	—	− 1*
Wool	87	33	32	32	33	34

* Decrease.

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Importation of Raw Cherries Order of 1927

IT will be remembered that the discovery, by the Ministry's Inspectors, of numerous consignments of French cherries seriously infested with the Cherry Fruit Fly, which causes serious damage in cherries in some countries but, happily, does not exist at the present time in English orchards, led the Ministry to make an Order in June, 1926, requiring all consignments of cherries imported from France to be accompanied by a certificate to the effect that the Cherry Fruit Fly was not known to exist in the Department in which the cherries were grown.

The sampling of consignments of French cherries carried out by the Ministry's Inspectors, both before and after the issue of the Order, showed that perfectly clean consignments and heavily infested fruit were being despatched at the same time and from the same district ; and the Ministry accordingly invited the French Government to consider whether measures could not be devised which would effectually prevent the

export of infested cherries, and admit of the export of clean fruit needed for consumption in this country.

As the result of these representations, the French Government have drawn up a scheme which places the whole export of cherries to this country under the control of a National Syndicate. The export of cherries highly susceptible to the Fruit Fly is prohibited; the members of the Syndicate bind themselves to export only clean fruit, and French Inspectors will carry out an examination before consignments are shipped. Every package passed for export will bear a special label officially stamped as an indication that its export has been authorized by officers of the French Phytopathological Service.

The Importation of Raw Cherries Order of 1926 has, therefore, been revoked and replaced by the Importation of Raw Cherries Order of 1927. The new Order prohibits the entry of any cherries shipped from a French port unless accompanied, in the case of French cherries, by a certificate of an officer of the French Phytopathological Service to the effect that examination of the consignment has not revealed the presence of the pest in any stage of its existence, and that the packages bear the label of the Syndicate on which is an official stamp indicating that they have been examined and that they have been exported in accordance with the Syndicate's regulations. Consignments of cherries not grown in France but shipped from a French port must be accompanied by a certificate of origin.

Copies of the Order may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W. 1.

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Importation of Potatoes (Canary Islands) Order of 1927

THE following Press notice was issued on May 3: In view of the discovery of the Potato Moth in consignments of potatoes imported this season from the Canary Islands, the Minister of Agriculture and Fisheries has made an Order under the Destructive Insects and Pests Acts 1879 and 1907 prohibiting the landing in England and Wales of any potatoes grown in the Canary Islands unless they are accompanied by the certificate of health prescribed in the Destructive Insects and Pests Order of 1922. The Order came into operation on May 2, but it allows for the landing of potatoes shipped from the Canary Islands prior to that date.

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on April 25 at 7 Whitehall Place, S.W. 1, the chairman, Lord Kenyon, presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions.

Cumberland and Westmorland.—An Order continuing from June 5 until further notice the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rates in the case of male workers of 21 years of age and over are 38s. per week of customary hours in the case of workers hired by the month or longer period, 31s. per week of 48 hours in winter and 32s. 6d. per week of 54 hours in summer for other male workers except in the case of casual workers, where the minimum rate is 8d. per hour. The overtime rate for all classes of male workers of 18 years of age and over is 8½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5½d. per hour for all time worked.

Dorset.—An Order fixing special differential rates of wages for overtime employment of male workers on the hay and corn harvests, the rate in the case of workers of 21 years of age and over being 10d. per hour.

Durham.—An Order fixing minimum and overtime rates of wages for male and female workers to come into operation on May 14, when the existing rates are due to expire, and to continue in force until May 13, 1928. The minimum rates in the case of male workers of 21 years of age and over are: Horsemen who are householders, 32s. per week of 50 hours, and in addition 7s. per week to cover all time customarily spent in attention to horses; horsemen who are not householders and who are not in receipt of board and lodging, 31s. per week of 50 hours, and in addition 3s. 6d. per week to cover all time customarily spent in attention to horses; horsemen who are in receipt of board and lodging, 31s. per week of 50 hours, and any additional time customarily spent in attention to horses; stockmen or shepherds who are householders, 43s. per week for hours customarily spent in attention to stock; stockmen or shepherds who are not householders and who are not in receipt of board and lodging, 36s. 10½d. per week for hours customarily spent in attention to stock; stockmen or shepherds who are in receipt of board and lodging, 35s. per week for hours customarily spent in attention to stock; and other male workers 31s. per week of 50 hours. These rates represent a reduction of 1s. per week in all cases except those of horsemen, stockmen, and shepherds who are householders. The overtime rates in the case of all classes of male workers of 21 years of age and over are 10d. per hour in respect of overtime employment on Sunday and after 12 noon on Saturday and 9d. per hour for other overtime employment. In the case of female workers of 18 years of age and over the minimum rate is 2s. 6d. per day of eight hours with overtime at 4d. per hour.

Essex.—An Order fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers to come into operation on May 1, when the existing rates are due to expire, and to continue in force until October 31, 1927. The

minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays (instead of 9d. per hour for all overtime employment as at present). The minimum rate in the case of female workers of 21 years of age and over is 5½d. per hour (instead of 6d. per hour as at present) for all time worked.

Herefordshire.—An Order varying as from May 1 the minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are 36s. per week for all time customarily spent on the immediate care of animals (not exceeding 60 hours) in the case of bailiffs, waggoners, stockmen and shepherds, and 31s. per week of 53 hours in summer and 48 hours in winter (instead of 52 hours in summer and 48 hours in winter as at present) for other male workers. The overtime rate in the case of all classes of male workers of 21 years of age and over is 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 4½d. per hour for a week of 46½ hours, with overtime at 6d. per hour (instead of 4½d. per hour for all time worked as at present). The rates as varied will continue in force until April 30, 1928.

Lancashire.—An Order varying as from May 2 the minimum and overtime rates of wages for male workers and minimum rates of wages for female workers to continue in force until April 30, 1928. The minimum rates in the case of male workers of 21 years of age and over are: In the Southern area 37s. per week of 52½ hours in the case of stockmen and teamsmen and 33s. 6d. per week of 50 hours in the case of other male workers; in the Eastern area 42s. per week of 60 hours in the case of all classes of male workers; and in the Northern area 40s. per week of 60 hours for stockmen and teamsmen and 37s. 6d. per week of 60 hours in the case of other male workers, overtime being payable at 11d. per hour in all cases. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for all time worked.

Oxfordshire.—An Order continuing as from May 1 until further notice the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 48 hours in winter and 50 hours in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for all time worked.

Somerset.—An Order fixing special differential rates of wages for overtime employment of male workers on the hay and corn harvests, the rate in the case of workers of 21 years of age and over being 10d. per hour.

Wiltshire.—An Order fixing special differential rates of wages for overtime employment of male workers on the hay and corn harvests, the rate in the case of workers of 21 years of age and over being 9d. per hour.

Merioneth and Montgomery.—An Order continuing as from May 2 until May 1, 1928, the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rates in the case of male workers of 21 years of age and over are 34s. 6d. per week of 60 hours for stockmen, teamsters, carters and shepherds, and

31s. 6d. per week of 54 hours for other workers, overtime in each case being payable at 9d. per hour. The minimum rate in the case of female workers of 18 years of age and over is 5d. per hour for all time worked.

Radnor and Brecon.—An Order to come into operation on May 1, when the existing rates are due to expire, and to continue in force until October 31, 1927, fixing minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 54 hours in summer and 48 hours in winter (instead of 30s. as at present) with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6¼d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Special Minimum Rates of Wages for the Hay Harvest.—Special rates of wages for employment on the hay harvest in 1927 have been fixed by five Agricultural Wages Committees, *viz.*, Derbyshire, Devonshire, Dorset, Somerset and Wiltshire. In every case, except Wiltshire, similar rates were fixed last year. In the case of Hertfordshire, where special rates were fixed last year, no proposal in regard to harvest rates has yet been issued.

The rates apply to male workers only, and in each case there are special differential rates of wages for overtime employment on harvest work, the rates for workers of 21 years of age and over being 10d. per hour in Devonshire, Dorset and Somerset and 9d. per hour in Derbyshire and Wiltshire. Lesser rates are fixed for younger workers.

In the areas where the Agricultural Wages Committees have not fixed any special rates for hay harvest, employment on such work must, of course, be paid for at not less than the ordinary minimum and overtime rates.

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Enforcement of Minimum Rates of Wages.—During the month ending May 15 legal proceedings were instituted against ten employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages			Workers concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Devon ..	Exeter ..	2	2	0	4	5	6	22	11	6	4
,, ..	Holsworthy ..	0	10	0	0	5	0	29	6	9	1
Dorset ..	Wimborne ..		—			—			—		1
Salop ..	Shrewsbury ..	1	0	0	0	12	0	19	0	0	4
,, ..	,, ..	1	0	0	0	8	0	11	15	9	2
,, ..	,, ..	1	0	0	0	5	0	2	16	4	1
Derby ..	Belper ..	0	10	0		—		13	0	0	1
Cornwall ..	Launceston ..		—		1	19	0	15	10	0	2
,, ..	Liskeard ..	2	0	0		—		20	0	0	1
Cheshire ..	Northwich ..	6	0	0	2	17	0	147	10	9	6
		£14	2	0	£10	11	6	£281	11	1	23

With regard to the case dismissed at Wimborne, it transpired in Court that the worker was not in the service of the employer concerned on the particular day to which the summons related. The employer, however, intimated that he did not propose to withhold from the worker on account of a legal technicality the arrears of wages which might be due, and the Ministry therefore decided not to pursue the matter further.

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Foot-and-Mouth Disease.—No outbreak of disease has been confirmed since that at Ellel, Lancashire, which was discovered on April 6 last, and was referred to in the May issue of the JOURNAL. All restrictions in connexion with that outbreak were removed on May 4, and the position is that, as from that date, no general movement restrictions in connexion with foot-and-mouth disease remain in force in any part of Great Britain.

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Instruction in Seed Testing.—A course of training in seed testing will be held at the Official Seed Testing Station for England and Wales, Cambridge, from June 28 to July 26, 1927. It will be followed by an examination in seed testing on July 27 and 28. The fee for the course and examination is £6 6s., and for the examination only £1 1s. Full particulars can be obtained from the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

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Prosecution under Tuberculosis Order, 1925:—A farmer in Durham was recently prosecuted by the County Council for failing to report tuberculosis in one of his cows. The local Bench of Magistrates dismissed the case, but the Local Authority appealed to Quarter Sessions, who convicted the owner, imposing a fine of £20, and ordering him to pay the costs of appeal, which were stated to be £78. The Chairman of the Quarter Sessions, in remarking upon the case, said that so serious was the offence of keeping a cow which gave tuberculous milk that, in addition to the other penalties, the farmer ought not to receive any compensation under the Tuberculosis Order for the loss of the animal.

It is fairly well known now by farmers that those who have cows which appear to be suffering from tuberculosis of the udder, indurated udder or other chronic disease of the udder, or from tuberculous emaciation, or which have a chronic cough, and show definite clinical signs of the disease, are required by law immediately to report such cases to the police, with a view to the animals being slaughtered by the local authority under the Tuberculosis Order, provided of course that the veterinary examination instituted by the local authority shows them to be suffering from the disease. Compensation is paid for animals so slaughtered at the rate of three-quarters of the market value in non-advanced cases, and one-quarter in advanced cases, subject to a minimum of 45s.

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Sale of Plants.—The Minister of Agriculture and Fisheries has issued an Order entitled "The Sale of Diseased Plants Order of 1927," which takes the place of the Sale of Diseased Plants Order of 1922,

and the American Gooseberry Mildew Order of 1919. It came into force on April 25, 1927, and copies may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1. The effect of the Order is to prohibit the sale, or exposure for sale, of any plant which bears evidence of having been substantially attacked by the Apple Capsid, or of any trees, shrubs, seeds, tubers, bulbs, layers, cuttings or any other parts of a plant which are substantially attacked by the following pests: Fruit Tree Cankers, American Gooseberry Mildew, Silver Leaf, Black Currant Mite, Woolly Aphis, all Scale Insects, Brown Tail Moth, Rhododendron Bug, and Powdery or Corky Scab of Potatoes.

The reason for the Order is the serious complaints which have been made to the Ministry, during the past few months, of the increase of the Capsid Bug on apple trees in certain districts. The need for a drastic Order was strongly urged, and the Ministry, after full consideration of the advice of its Horticultural Advisory Council, decided that the most practicable method of dealing with the matter was to add the the pest to the Schedule to the Sale of Diseased Plants Order. The opportunity was taken of making other small amendments of the regulations, and the new Order is the result.

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NOTICES OF BOOKS

Farmers of Forty Centuries; or, Permanent Agriculture in China, Korea and Japan. By F. H. King. (London: Jonathan Cape, 1926. pp. 379. Price 12s. 6d. net.)

The late Professor King, when at Wisconsin, carried out a number of investigations on soil physics—and particularly on the movements of water in the soil—which about 25 years ago were about the best work then being done in a field that was but little explored. Later, he went to Washington to the Department of Agriculture, but a disagreement as to the policy regarding research on soil problems led him to resign and to carry out a long-felt desire to examine the soils and agriculture of China and Japan. King died before he had quite completed the record of his observations, and the book, which was prepared for press by his widow, was first published in 1911.

For the Western reader, it is a fundamental book—the first statement of a secular system of agriculture and soil conservation that demands the earnest consideration of everyone who is thinking of the future of agriculture and the maintenance of the food supply of the world.

The conditions permitted to King no more than a hasty survey of a vast area, and the more recent penetration into China of American men of science and the development of agricultural science in Japan have doubtless led to a revision of some of King's statements, but the book perhaps gained more than it lost from the speed with which it was compiled: King saw the wood even if some of the trees are out of perspective.

The central fact that emerges is the density of the population that is maintained by the land in these Eastern countries. The English population is the densest in Europe, averaging 701 to the square mile, yet, as we know, at least four-fifths of it lives in towns and cities. King reports that in Chungming, at the mouth of the Yangtse River, there is a density of 3,700 per square mile, with only one city in the total area of 270 square miles. Western agriculture requires 2 to 2½ acres to produce the food for one unit of population; King shows that these Eastern peoples live on one-tenth of that area. It is accomplished

in the first place by minute and careful farming, with an excessive ratio of labour to production, compared with which our market gardening is extensive and wasteful of land. Soil fertility is maintained by the return to the land of the elements drawn from the soil; human urine and excreta are preserved and constitute the chief fertilizer. The universal drink is tea and the boiling of the water obviates the risk of disease. The second condition is a reduction of the standard of living to the minimum—the cash equivalent of the earnings of the cultivator may be estimated at less than 6d. a day. A corollary is the ever-present danger of famine in districts where the population live thus on the bare edge of subsistence. Space does not permit of any discussion of the book in detail, but it is eminently readable and it is worth reading; and it must compel the reader to think about certain world problems which have seemed very remote to us, but may soon become pressing. The population of the world is always increasing. Will the pressure thus generated force the Western peoples into as intensive farming and as low a standard of living? If, by limitation of the rate of birth, the Western nations insist on their standard of living, how will they maintain themselves commercially against the races on their flank with so low a standard? Lastly, what is going to be the effect both upon China, and by reaction upon ourselves, if these vast hardy and toilsome populations become infiltrated with the explosive doctrines of modern Russia?

The National Farmers' Union Year Book, 1927. (Published by the Union at 45 Bedford Square, London, W.C. 1. Price 5s. net.)

The N.F.U. Year Book for 1927 summarizes the multiform activities of the Council and its several Committees in the past year. A glance at the various Committee reports shows at once the comprehensiveness of the work undertaken by this powerful organization in the interests of its members and of the agricultural industry. But the book is more than a record of effort and achievement; it is a work of reference indispensable to the farmer who would be well-informed in matters of education and legislation affecting his occupation. Chapter 1 outlines the co-ordinated scheme of agricultural education and research now in force throughout the country and indicates the source to which a farmer should apply if he desires to take advantage of any of the educational facilities provided through the County Councils, Colleges or Research Institutions.

In a brief note, the Director of Rothamsted, Sir John Russell, deals with the application of science to agriculture, mentioning as the outstanding feature of 1926 the great development of the manufacture of nitrogenous fertilizers from the air. One result of the greatly increased production that will appeal to the farmer has been a lowering of price, so that sulphate of ammonia is now cheaper than it has been for the past seven years. Various new compounds of synthetic nitrogen will shortly be on the market, substances which have certain important advantages over ordinary mixed fertilizers. They are much more concentrated, and the whole of their nitrogen and phosphorus is soluble and available.

Professor Gaiger describes the results of recent research in animal nutrition, *e.g.*, the effects of ultra-violet rays, vitamins and minerals; and also discusses the progress made in connexion with animal diseases, such, for example, as the vaccine treatment for the prevention of tuberculosis.

Plant Pests and Diseases in 1926 are described and discussed by the well-known authorities, Messrs. Fryer and Pethybridge. Incidentally,

they make an earnest appeal for the co-operation of the practical farmer, so that, by comparing the variation in insect abundance with other changing factors, such as weather, parasites, farming practice, etc., they should be able to get at the reasons why certain pests are prevalent in some years and almost entirely absent in others. Such information might lead to satisfactory measures of control. For instance, in 1926, the frit fly caused less injury to oats than for many years past. While it may be that the oats that year got a good start and so evaded attack, there is evidence that the flies themselves were actually scarcer, and the chances are that spring oats should be relatively safe this year.

In regard to matters of legal interest, Mr. C. H. Tolley contributes a very useful article on Farmers' Income Tax, which is followed by a summary of the legislation affecting agriculture in 1926, together with a helpful index to Acts of Parliament dealt with in previous issues of the Year Book.

Chapter 4 is devoted to a statistical review of wages, prices and supplies; and in Chapter 5 the official agricultural programmes of the three political parties are briefly and effectively analyzed and compared. There follows a miscellany of information for tenants and owner-occupiers on matters of recurrent incidence, such as Agricultural Returns, boundary fences and trespass, improvements, disturbance, tenancy agreements, rating and so on. A further chapter catalogues the Government Departments, with their principal officers, concerned in matters affecting agriculture.

The Physiology of Reproduction in the Cow. By J. Hammond, M.A. (Cambridge University Press. Price 21s. net.)

An understanding of the principles underlying the scientific breeding of farm stock has been greatly handicapped for many years by the absence of a reliable book of reference, embodying the observations of breeders, and the results of research into what has, until lately, been regarded as a recondite subject. Various phases of the physiology of reproduction in the cow have been recorded by veterinary clinicians, various workers in the biological field, and observant breeders of cattle; but there has been no comprehensive attempt to co-ordinate this mass of information and supplement it by controlled investigation of the oestrous cycle.

Mr. Hammond has essayed this task with a large measure of success, and the resulting book, based on very careful experimental work, and a critical survey of the scattered literature of the subject, will prove a valuable book of reference and text-book, not only to Veterinary and Agricultural students, but to anyone engaged in elucidating the very varied problems of genetics in the cow.

The author has kept the comparative aspect of the subject well to the fore. This method of treatment makes the text more interesting, and adds materially to the value of the opinions expressed. The experimental work has been carried out at the Field Laboratories of the University of Cambridge.

As the introduction states, this work is intended to have a direct bearing on herd management, calf-rearing, and milk production. The opening section on the breeding season summarizes what is known regarding breed variations and seasonal fluctuations, and shows that, although the reproductive force is at its maximum in the summer and at its minimum in the winter, yet there is an optimum temperature governing the length of time between calving and the next fertile service. The oestrous cycle is then fully discussed. The study of it

was ingeniously facilitated by the use of a vasectomized bull, which, being unable to eject spermatozoa, did not interfere with the course of oestrus in the animals under observation. It was found that the length of the cycle and the duration of oestrus were correlated, and were uninfluenced by drugs, the proximity of the male or coitus. The ovarian, uterine, and vaginal changes during the cycle are described in detail, and illustrated by very fine photographic illustrations. Plate I admirably illustrates the "wax and wane" of the follicles and corpora lutea. A little more explanatory description on some of the plates themselves would have enhanced their value.

The diagnosis of pregnancy is discussed. Reference is made to palpation of the fœtus through the flank, and here the author has rather confused "symptom" with "method." The disposition, size, and consistency of the uterus and fœtus in succeeding months of pregnancy, as disclosed by rectal examinations, are given in detail. As an indication of pregnancy, one can hardly agree that one of the methods, viz., hooking the os and pulling it back into the vagina, in order to examine the mucous secretion, is a safe procedure, or one that could be recommended as a routine practice.

The development of the mammary gland during a first pregnancy is described in all its stages, and the influence of the internal secretions considered. The view, accepted by many, that secretion of milk at birth is due to the removal of an inhibitory factor (fœtus or placenta), does not receive support from the experiments conducted, and an interesting alternative theory is put forward.

The book concludes with a section on sterility. The author in his references has rather overlooked the activities of British veterinarians, in dealing with sterility due to persistent corpus luteum and cyst formation. Interesting theories are advanced regarding the interrelation between the corpora lutea and the maturation of the Graafian follicles in the ovary. The view is put forward that absence of heat is due to the formation of large single cysts, and that nymphomania is due to multiple small cysts. Further post-mortem work on known cases of these conditions is required to substantiate this. The difficulty of differentiating between multiple small cysts and normal follicles is admitted. Several causes of sterility are not mentioned, but the section is mainly devoted to a general consideration of the various factors responsible. The views advanced by a number of authorities are also recorded and discussed.

The format of the book is excellent, and a very complete bibliography is appended for the use of those who intend to go more deeply into an absorbingly interesting subject.

Principles of Plant Growth—An Elementary Botany. By Wilfred W. Robbins. (Chapman & Hall, Ltd. Price 11s.)

This is a comprehensive and well-written book, which aims at presenting, in non-technical language, some of the fundamental principles of plant growth. In this sense, it has fulfilled its purpose. It will be welcomed by the grower who, while desirous of understanding basic principles, is averse from the study of structural details.

The book is also designed as an elementary text-book in secondary schools. In the sense that it links up botany with practice in the farm and garden, it is superior to the general run of school text-books, but 11s. is a rather high price for parents to face nowadays.

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THE JOURNAL
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JULY, 1927.

NOTES FOR THE MONTH

The National Institute of Agricultural Botany

THE means of interesting agriculturists in the practical results of research work and securing their support for its development is a matter that rightly commands a good deal of attention. Of the methods hitherto adopted by the research institutions themselves, one of the most interesting is the Fellowship of the National Institute of Agricultural Botany. This was instituted a few years ago to enable everyone, who has at heart the improvement of farm crops and the success of British agriculture, to keep in close touch with the development of the Institute's work, and, through their representation on its Council, to assist in its direction. There are already more than 400 Fellows, including Their Royal Highnesses the Prince of Wales and the Duke of York, also many of our statesmen and of the leaders of the agricultural world. There must be many more agriculturists who would wish to participate by this means in the Institute's work, and for this reason the Ministry desires to bring the Fellowship to the notice of farmers and others who may be interested. (See also the announcement of the N.I.A.B. on p. i.)

The aim of the Institute is to improve the yield and quality of farm crops by encouraging the use of better varieties and better seeds. It is endeavouring to discover which are the most remunerative crops and which the most remunerative varieties for each district, and to ensure that pure, viable and healthy seed of the best varieties is readily available. The significance of this undertaking can be measured from the facts that the difference in value between two varieties often amounts to over 20 per cent. and that an addition of 3 per cent. to the yield would increase the value of the corn and potato crops by over a million pounds a year.

The present work of the Institute falls into three branches. One, the Crop Improvement Branch, is equipped with a trial

ground at Cambridge, and five sub-stations in other parts of England, for accurate field testing of old and new varieties of agricultural plants. It is also prepared to undertake the introduction of new varieties of merit by arrangement with breeders. A second branch, the Official Seed Testing Station for England and Wales, tests some 25,000 seed samples a year for purity and germination, and, at a nominal fee, insures farmers against the loss entailed by sowing dead or dirty seeds. The investigation of seed-borne diseases, and of the numerous problems that seeds present to agriculturists, are other important features of the Station's work. The Station is operated by the Institute on behalf of the Ministry. At the third branch, the Potato Testing Station, Ormskirk, the official Wart Disease Immunity Trials are carried out for the Ministry, and the Institute conducts the Lord Derby Gold Medal Trials (with the aid of the local Committee) and yield and maturity trials of leading potato varieties. In order to prevent old varieties being marketed under new names, at high prices, the Potato Synonym Committee reports annually on the stocks entered for the Immunity Trials. The latest development is a field investigation of the virus diseases that are now believed to reduce the country's potato crop by something like a million tons a year.

Copies of the last annual report, with full particulars of the Institute's activities and of the Statutes of Fellowship, can be obtained by writing to the Secretary, N.I.A.B., Huntingdon Road, Cambridge. Both the Ministry and the Council of the Institute believe that the facilities given to Fellows to keep in touch with the development of its work will be of value to them. At the same time the hope that readers of this JOURNAL will become associated with the Institute by becoming Fellows is based not on the advantages to themselves but on the strength given to the Institute by their moral and financial support, and their continuing interest in the work.

* * * * * *

Marketing of Home Produce : Report

IT may be recalled that a grant of £40,000 a year for five years was made by the Empire Marketing Board for the purpose of carrying out further investigations into the marketing of home-grown agricultural produce and for demonstrating improved methods. An account was given in this JOURNAL for March, 1927, p. 1073, of the various activities of the Ministry which had been undertaken

up to December 31, 1926, with the aid of this grant. A further brief report of progress for the quarter ended March 31, 1927, may prove of interest.

Publications.—One report in the Economic Series was issued during the quarter, namely, No. 15 (*Fruit Marketing in England and Wales*). With the aid of the grant this report was issued at 6d. net; its sales up to March 31 amounted to 2,340 copies. The price of Reports Nos. 7 (*Wool Marketing*) and 9 (*Marketing of Potatoes*) was reduced at the end of the quarter from 1s. 6d. to 6d. The largest sales of individual reports in the Economic Series up to March 31, 1927, were as follows :—

No. 1 :	*Co-operative Marketing*	1,921	(Published April, 1925).
No. 4 :	*Co-operative Marketing in U.S.A.*	1,018	(,, June, 1925).
No. 8 :	*Agricultural Credit* ..	1,377	(,, Feb., 1926).
No. 10 :	*Egg Marketing* ..	4,511	(,, Jan., 1926).
No. 11 :	*Marketing of Poultry* ..	4,896	(,, Oct., 1926).
No. 12 :	*Marketing of Pigs* ..	2,180	(,, Oct., 1926).
No. 15 :	*Fruit Marketing* ..	2,340	(,, Mar., 1927).

Marketing Investigations.—Investigations are in progress in regard to the marketing of cattle, vegetables, butter, cheese and cream. A report on the fluid milk market has been completed, and will be issued as No. 16 in the Economic Series. Reports on the marketing of cereals and pig products are well advanced, as also is the second volume of *Markets and Fairs in England and Wales*—the first volume was published on April 13 as No. 13 (*Markets and Fairs in England and Wales, Part I, General Review*). A report dealing with marketing problems of individual fruits (apples, pears and plums) is in preparation.

Marketing Demonstrations.—The practical demonstration of improved methods of marketing is an essential feature of the Ministry's scheme, and, as already announced in this JOURNAL, arrangements have been made for staging such demonstrations at a number of agricultural and other shows during the present year. The subjects being dealt with at the summer shows are eggs, poultry, fruit, pigs and pig products.*

Egg Marketing Poster.—A large poster calling attention to the points to be observed when marketing eggs has been prepared and distributed to those responsible for the conduct of country markets. This poster is meeting a long-felt want and has been very favourably received. It has been translated into Welsh for distribution in the Principality, and is everywhere in keen demand.

* The nature and scope of the demonstrations are explained on pages 316 *et seq.* of the present issue of the JOURNAL.

Packages for Eggs and Dressed Poultry.—The Committee which has been considering this subject held several sittings during the quarter and completed its inquiries.†

Marketing Leaflets.—Two of the leaflets reproduced in this JOURNAL for December, 1926 (*Hints on the Marketing of Eggs* and *Hints on the Marketing of Poultry* respectively), have also been translated into Welsh.

Grants-in-Aid.—A grant of £100 to the Cottenham Growers, Ltd., has been sanctioned, to enable that society to employ a manager capable of keeping proper cost accounts to show the details of the expense of running an apple grading and packing station. These accounts are to be placed at the Ministry's disposal for publication if necessary.

Negotiations are in progress in respect of the loan by the Ministry of grading plant and equipment (estimated to cost about £400) to enable an apple grading station to be set up at Terrington St. John's, near Wisbech. One of the conditions of the arrangement is that cost accounts shall be kept and placed at the Ministry's disposal.

A grant of approximately £700 a year has been made to the Agricultural Economics Research Institute at Oxford in aid of detailed investigations into marketing problems of particular localities. Steps have been taken to ensure that these investigations will be brought into due relation with the general marketing work of the Ministry.

Displays of Empire Produce.—Empire shopping weeks and exhibitions of Empire produce are being organized under the ægis of the Empire Marketing Board in various parts of the country. The Ministry is taking all possible steps to ensure that home produce receives effective representation in these schemes. Details of the displays of home produce at the British Industries Fair (February, 1927) and at the Ideal Homes Exhibition (March, 1927) have already appeared in this JOURNAL.

* * * * * *

Cheshire Cheese

FARMERS generally, and all concerned with the marketing of home produce, will watch with interest the progress of the Cheshire Cheese Federation's scheme which is designed to raise and standardize the quality of English Cheshire cheese and to advertize the standardized product. A trade mark consisting of three "C's" intertwined ("Choicest Cheshire

† Report since issued as Marketing Leaflet No. 5. See JOURNAL for June, 1927, pages 223 to 238.

Cheese") has been adopted, and any producer in the area whose dairies conform to the Milk and Dairies Order 821, 1926, and whose cheese satisfies a certain standard on examination, will be authorized to imprint the trade mark on his produce. The standard specified is high.

The Federation has appointed a grader to inspect the premises of applicants for membership and to analyze samples of their cheese. The grader will also, from time to time, make similar inspections of members' premises and analyses of their produce in order to ensure that the standard is maintained. It is understood that about a hundred farmers have already applied for registration, and the grader is dealing with these applications as expeditiously as possible.

The first consignment of graded cheese was offered for sale at the Chester Cheese Fair on June 1. It is satisfactory to record that there was a keen demand, and 1d. a lb. more was realized than the highest price recorded for the ungraded product. At Whitchurch Cheese Fair on June 8, graded cheese realized 8¾d. a lb. against 8d. a lb. for best ungraded.

The income of the Federation is derived from a registration fee of from £1 to £2 (according to size of farm), plus an output levy of 2d. per cwt. As, however, this experiment in marketing reform cannot fail to prove of value, not only to the cheese industry, but to other branches of British agriculture, the Ministry is helping to overcome initial financial difficulties by making a grant to the Federation of a sum not exceeding £1,500, to be spread over the first two working years of the scheme; the grant will be made from the funds placed at the Ministry's disposal by the Empire Marketing Board.

* * * * * *

International Institute of Agriculture

THE Institute has recently endeavoured to effect an improvement in its publications by merging the two quarterly reviews previously published under the titles of *The International Review of the Science and Practice of Agriculture* and *The International Review of Agricultural Economics* into one publication entitled *The International Review of Agriculture*. The idea underlying this change is to present, in one publication, a more general view of the work of the Institute. This new review is being published monthly, and the first issue relates to February, 1927. In addition to information regarding economic and social questions affecting agriculture, and the science and

practice of agriculture in various countries, the review contains sections dealing with agricultural statistics and legislation, and the current activities of the Institute. Only the most important statistical information is included, however, and the *International Crop Report and Agricultural Statistics* will continue to be published monthly as before.

As a result of a resolution passed at a meeting of the International Conference on Tropical Agriculture held in Paris last year, and of decisions taken at the last meeting of the General Assembly, the Institute has decided to form a separate Bureau for Colonial and Tropical Agriculture. Arrangements have been made to hold a meeting of the "Tropical Agriculture" Committee of the International Scientific Council in June, to discuss the best way in which the Institute can act in this matter, and the subject will be further discussed at the full meeting of the International Scientific Council in November.

The International Conference of Wheat Experts, organized by the Institute at the invitation of the Italian Government, was held at the Institute's headquarters from April 25 to 30, and was attended by representatives of 37 States, including those of all countries in the British Empire adhering to the Institute. The Conference was divided into two parts, (*a*) scientific, (*b*) economic and commercial, and the general results were contained in a series of resolutions which will in due course be printed and circulated with all the relevant documents. It was decided to hold another Conference in 1929 or 1930, and the Institute was asked to form a special section for the study of questions relating to wheat and also to establish a separate sub-committee attached to the International Scientific Council.

* * * * * *

THE PRODUCTION REQUIREMENT OF FATTENING SHEEP

T. B. WOOD, C.B.E., F.R.S.,

Drapers' Professor of Agriculture, and Director of the Animal Nutrition Research Institute, School of Agriculture, Cambridge University.

IN 1924, the writer propounded a new method of computing rations for cattle, sheep and pigs.[1] The essential point of the method depends upon the separate computation of the requirement for maintenance and for the desired amount and kind of production, usually in the form of increased live-weight. The method is on the same lines as that which had been used for dairy cows for some time with great success. Its proposed extension to other kinds of animals presupposes accurate knowledge of maintenance requirements and of production requirements. By production requirement is understood the amount of food, measured in starch equivalent or in calories, which is required to produce 1 lb. of live-weight increase.

The idea is exactly similar to that used in rationing milch cows, in which case it is generally accepted that 2½ lb. of starch equivalent is the production requirement of 1 gallon of normal milk. It is, however, well known that the requirement per gallon of milk varies according to the composition of the milk. In the same way, the production requirement per lb. of live-weight increase must be expected to vary within wide limits. In the case of very young animals, live-weight increase consists for the most part of water, and is, therefore, produced by the consumption of very little food. The writer has shown,[2] for instance, that, in the young pig, 600 calories, or less than ½ lb. of starch equivalent, can produce 1 lb. of live-weight increase. In the last stages of fattening adult animals, the increase consists almost entirely of fat. Consequently it may require as much as 4,300 calories, or 4 lb. of starch equivalent, to produce 1 lb. of live-weight increase. The production requirement of live-weight increase per lb. may, therefore, vary from ½ to 4 lb. of starch equivalent.

Accurate data for the maintenance and production requirements of the pig from weaning to factory weight have been published by the writer.[3] With Capstick,[4] the writer has also

[1] "Animal Nutrition"; University Tutorial Press, London, 1924.
[2] *Jour. Agric. Sci.*, Vol. XVI, 1926, 426.
[3] *Jour. Agric. Sci., loc. cit.*
[4] *Jour. Agric. Sci.*, Vol XVI, 1926, 326.

published a series of recent determinations of the maintenance requirement of sheep. The present communication is concerned with the production requirement of sheep. It is hoped in the near future to publish similar data on the production requirement of cattle.

There are three obvious methods of finding the production requirement of animals :—

(1) Statistical examination of the records of past feeding trials.
(2) Examination of the results of feeding trials designed specially for the purpose in view.
(3) Comparative slaughter investigations.

Methods 1 and 2 depend on the assumption that the metabolism of animals obeys the laws of the conservation of matter and energy—in other words that the starch equivalent, or net energy, in the ration consumed by the animals is completely used up by them in maintenance and in production. Method 3 also depends on an assumption, namely, that there is a constant ratio between the calories contained in live-weight increase and the starch equivalent, or net energy, required to produce that increase. Kellner showed that, in fattening cattle, 1 lb. of starch equivalent produced an amount of live-weight increase containing 1,070 calories. It is probable that a similar ratio would hold in fattening sheep. The justification of these two assumptions is discussed below.

Method 1 : Statistical Examination of Feeding Trials.—The writer hoped to find ample material for such an examination in Ingle's valuable tabulation of the records of sheep feeding trials.[5] Ingle's tables present, in convenient form, particulars of breed, age, live-weight, live-weight increase per week, and ration per week, of over 200 feeding trials, being all the trials recorded in British agricultural literature up to the year of publication. At the writer's suggestion, Mr. P. E. Graves examined the whole series by the following method. The recorded ration per week was calculated into starch equivalent, Ingle's calculation of starch equivalent having been made on an entirely incorrect basis. The starch equivalents used by Mr. Graves were those given in "Rations for Livestock."[6] The maintenance requirements were then read off from the curve, reproduced in Fig. 1, which was calculated by the two-thirds power law from Capstick and Wood's recent determination.[7]

[5] *Trans. Highland and Agric. Soc.*, 1910.
[6] Min. of Agric., Misc. Pub., No. 32, Fifth Edition, 1927
[7] *Jour. Agric. Sci., loc. cit.*

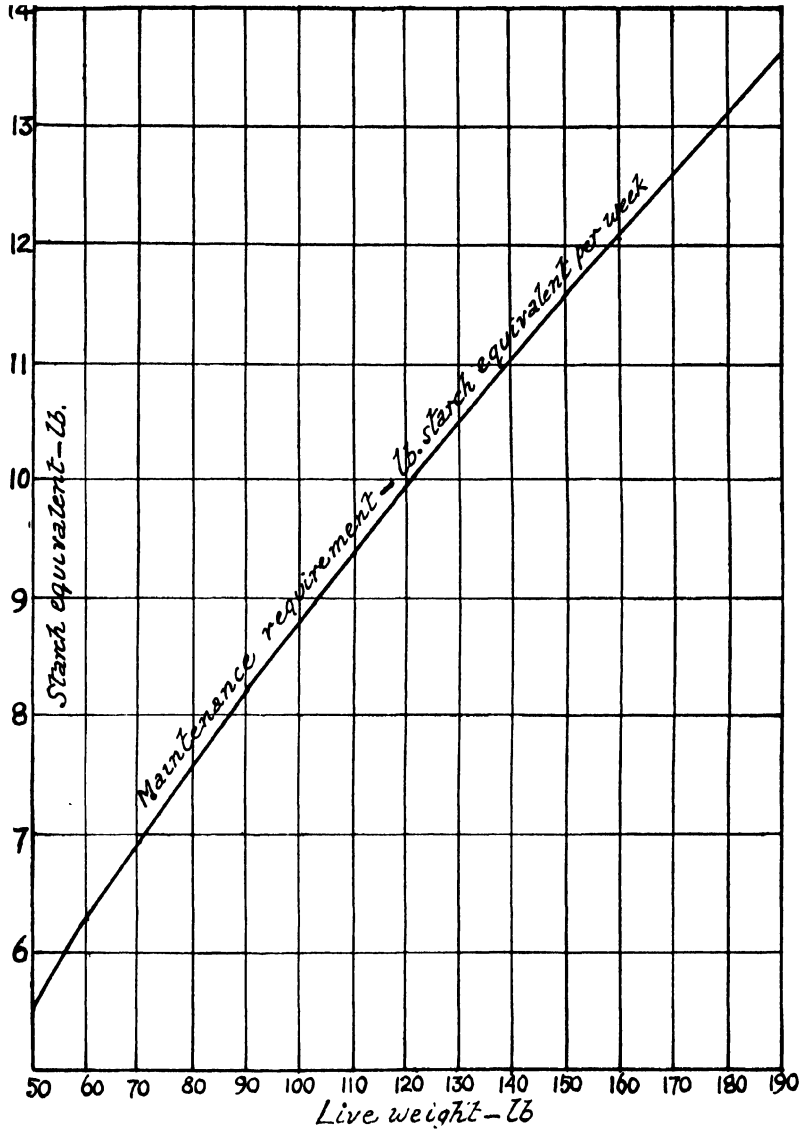

FIG. 1.

(*Copyright reserved, School of Animal Nutrition, Cambridge.*)

Then if R is the ration in lb. of starch equivalent per week, M the maintenance requirement in lb. starch equivalent per week, and G the live-weight increase per week, it follows from the first assumption given above, that :—

$$R = M + Gx$$

where x is the production requirement, *i.e.*, the weight in lb. of starch equivalent required to make 1 lb. of live-weight increase. This equation only holds if the animals are contented and comfortable, so that they make no considerable movements beyond the necessary movements allowed for in the maintenance requirement. The above equation may be written :—

$$x = (R - M) \div G.$$

Mr. Graves was good enough to work out the value of x for 187 of the 200 trials recorded by Ingle. It was impossible to work out the remaining 13 trials because the rations included feeding stuffs whose starch equivalent could not be computed. The results obtained from this very laborious undertaking were most disappointing. The values of x varied from 4·7 lb. of starch equivalent per lb. of increase, an impossibly high figure, even if the increase was entirely composed of pure fat, to — 3·2 lb. of starch equivalent per lb. of increase, which is, of course, manifestly absurd, since it means that the animals are credited with having made an appreciable increase in live-weight on a ration which was below their maintenance requirement. Wide variations in the value of x were to be expected, because the equation used above contains no term for the amount of food used in muscular movement,[8] which must vary from one trial to another. This, however, could not account for the large number of cases in which the value of x was negative.

Scrutiny of the rations of the various trials at once indicated that many of them were impossibly high or low, and this point was further investigated by calculating the weight of dry matter contained in each ration and comparing it with the weight of dry matter normally eaten by animals of the live-weights stated, this weight of dry matter being read off from the curve given in Fig. 2. This curve was originally plotted by E. T. Halnan and the writer from all data available to them, as for instance Kellner's Standards, Wolff's Standards, Armsby's Standards, and from figures collected by the late K. J. J. Mackenzie from successful practical sheep-feeders.

[8] *Jour. Agric. Sci., loc cit.*

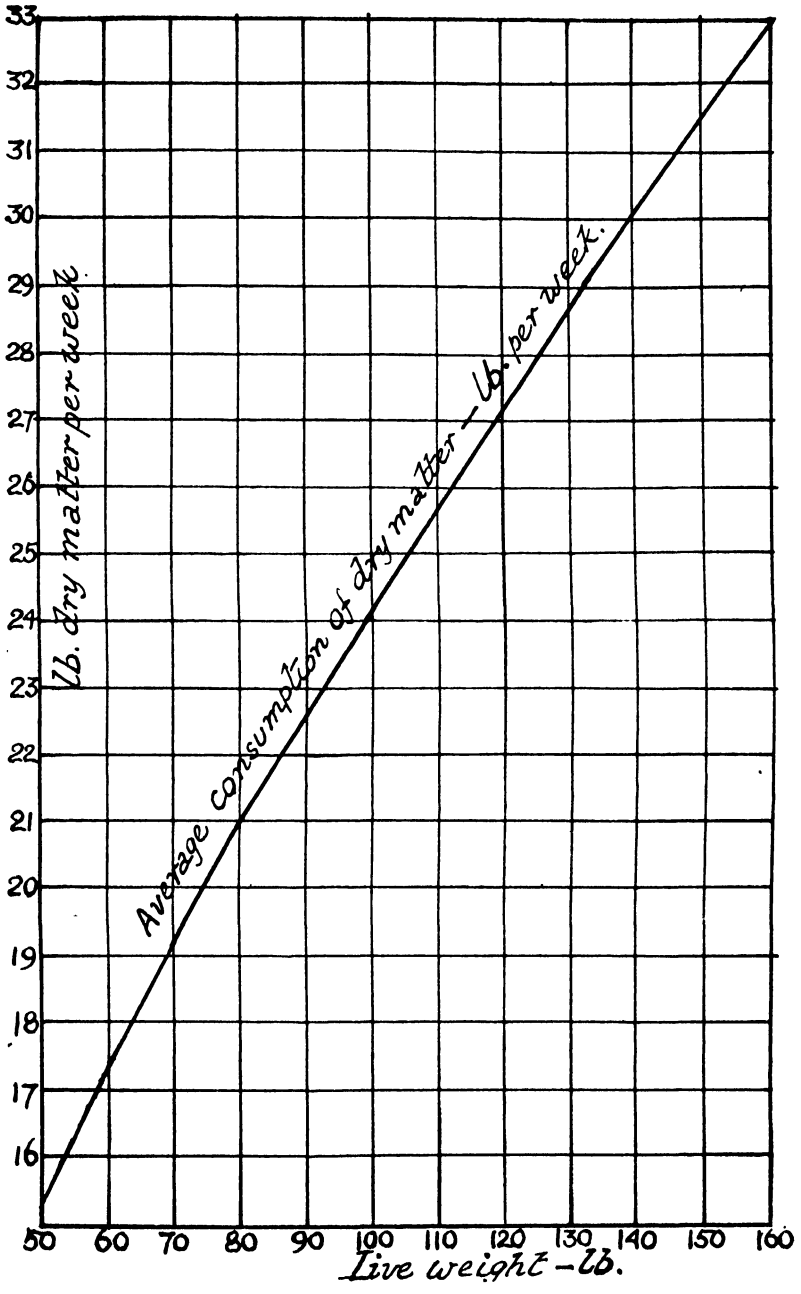

FIG. 2

(*Copyright reserved, School of Animal Nutrition, Cambridge.*)

The comparison showed that in only 27 trials was the dry matter consumption within 4 lb. per head per week of the normal consumption indicated by Fig. 2. The consumption of dry matter was usually below the normal consumption, frequently 10, 15, or even 20 lb. per head per week below. The most likely explanation was that the roots on which the sheep were folded still retained a large proportion of tops and leaves, which were eaten by the sheep, but omitted in recording the ration. It is, also, possible that the estimated yield of roots per acre, from which the ration was calculated, was incorrect, or that no account was taken of the fact that the sheep ate more roots as they increased in weight.

Whatever the explanation, the fact remains that only 27 of the 200 trials are suitable for the calculation of x, which greatly decreases the value of the average figure. From these 27 trials the average value of x is 2·3 ($\pm$ ·12) lb. of starch equivalent per lb. of live-weight increase.

Method 2 : Specially Designed Feeding Trials.—A series of feeding trials, specially designed to provide data for the calculation of the production requirement of fattening sheep, has been carried out by the writer, in collaboration with the Norfolk Agricultural Station, on Sidney Farm, Saxlingham, Holt, Norfolk, of which the writer has control. The sheep used for the trials were in all cases half-bred Suffolk lambs about seven months old at the beginning of the trial. The sheep were folded during the winter on marrow-stem kale or swedes, supplemented by good seeds hay, crushed barley and linseed cake, decorticated cotton cake, or decorticated cotton cake meal. Many disappointments were encountered, owing to difficulties of estimating the consumption of kale, showers during weighing and such like, but a number of reliable results were nevertheless obtained. These are given in Table I, which explains itself, except, perhaps, the column headed "Period of Fattening." The animals were folded for about six months. The figures given in this column indicate to which of these months the result applies.

It will be noticed that dependable results were only obtained for 18 months of the 42 months during which, in the aggregate, the sheep were folded, thus more than half the possible results were vitiated by showers during weighing, difficulties in assessing weights of roots, kale and tops consumed and such like unforeseen happenings which are inseparable from outdoor experiments. The mean value of x—the production require-

TABLE I.

Year of trial	No. of animals	Period of fattening months	Average live wt. lb.	Average increase per head per week lb.	Ration lb. S.E.	M. lb. S.E.	S lb. S.E.	Ration lb. Dry matter
1924-5 ..	40	3, 4, 5	107	*1·8 ± ·05	14·1	9·2	2·70	23
	40	3, 4, 5	102	*1·6 ± ·05	14·0	8·9	3·20	23
1925-6 ..	50	2, 3, 4	103	2·45 ± 0·5	14·1	9·0	2·09	23
	50	2, 3, 4	102	2·45 ± ·05	14·4	8·9	2·25	23
	50	2, 3, 4	98	2.31 ± .04	13·6	8·7	2·12	22
	150	5	127	2·19 ± .04	16·2	10·3	2·70	26½
1926-7 ..	120	4, 5	131	2·76 ± ·04	17·2	10·6	2·4	28½

* These low figures are accounted for by the uneasiness of the sheep, which for some unknown reason broke out of their fold several times.

ment—from the above table is 2·5 + ·14 lb. starch equivalent per lb. live-weight increase, a figure agreeing satisfactorily with that obtained from the statistical examination of Ingle's tables. It is also noteworthy that the production requirement is on the whole lower for the early months of fattening, increasing as fattening proceeds.

Method 3 : Comparative Slaughter.—This method was first used, in agricultural investigations, by Lawes and Gilbert at Rothamsted, in their classic work on the composition of the entire carcasses of cattle, sheep and pigs.[9] It has since been applied to sheep by Kern and Wattenberg and other German workers whose results have recently been recalculated and tabulated by Armsby and Moulton.[10]

The essence of the method is to select typical animals at definite stages of growth and fatness, to slaughter, dissect, sample and analyze, to combine the analyses of the samples so as to arrive at the composition of the entire carcass, and to compute the composition of the increase by subtracting from the weights of protein, fat, etc., in the older and fatter animal, the weight of the same constituents in the younger and less fat animal. It is usual to calculate the percentage of protein, fat, etc., in what is called the empty weight, which is the live-weight minus the contents of the alimentary canal and bladder.

Armsby and Moulton, in the re-calculations quoted above, give their final figures as calories per kilo of live-weight increase.

[9] *Phil. Trans.*, Part II, 1859, p. 493.

[10] "The Animal as a Converter of Matter and Energy": New York, 1925.

If it is assumed, as suggested above, that in the sheep, as in the bullock, 1 lb. of starch equivalent makes an amount of live-weight increase which contains 1,070 calories, then calories per kilo can be converted into starch equivalent by dividing by 2·2 × 1,070, and the quotient should give the corresponding production requirement in lb. of starch equivalent required to make 1 lb. of live-weight increase. This calculation has been made in Table II.

TABLE II

Authority, quoted from Armsby and Moulton	Age : months	Condition	Calories per kilo increase	Production requirement. lb. St. Equiv. per lb. increase
Kern & Wattenberg	7–13	low ration	4,888	2·04
,, ,,	13–22	low ration	6,622	2·81
,, ,,	22–28	low ration	7,155	3·04
,, ,,	7–13	high ration	5,456	2·33
,, ,,	13–18	high ration	7,799	3·20
,, ,,	?	last stage	8,801	3·75
Lawes and Gilbert	15	store to fat	7,073	3·00
Henneberg ..	33	same age	6,777	2·88

The average of all these results—2·88 lb. starch equivalent per lb. of live-weight increase—is sufficiently in agreement with the results of statistical examination of Ingle's tables —2·3—and of the writer's own feeding trials—2·5—to justify the assumptions, made in the introduction, that the whole of the starch equivalent in the ration is used up in providing for maintenance and production, and that the sheep, like the bullock, makes from 1 lb. of starch equivalent an amount of increase which contains 1,070 calories. The agreement between the three methods also shows that the estimates of maintenance requirements, used in methods (1) and (2), are sufficiently accurate, for they are not used in method (3), and still the result is substantially the same.

Kern and Wattenberg's figures form two series, the first on a low ration which produced a low rate of increase of only ¾ lb. per head per week ; the second on a higher ration giving a rate of increase of over 1 lb. per head per week. Both increases appear low as compared with British results, but their sheep were of the South Hanoverian breed, which are small and slow growing. In each series, the production requirement increases with age and condition.

As a final confirmation of all the figures obtained by the

three methods, the writer carried out a series of comparative slaughter experiments on five pairs of typical animals selected at intervals from the sheep used in the feeding trials at Saxlingham in 1924-25. The first pair were selected, as typical of the whole lot of animals, when they had been folded on roots for one month. Other pairs were selected at intervals of about three weeks, the last pair being picked out six weeks before the trial ended. Of the first and last pairs the duplicate animals gave almost identical results; the intermediate pairs were very unsatisfactory, the analyses of the duplicate animals varying so widely that the results were useless.

The following discussion, therefore, is based on the difference between the means of the first and last pairs of animals, the intermediate animals being ignored.

Method.—The method of selection was to pick out two animals having approximately the average live-weight of the whole lot. They were sent by rail to Cambridge, fasted overnight, and slaughtered. The blood was collected and preserved for further use. The skin and hoofs were removed and dried. The alimentary canal and bladder were removed and emptied, the contents being weighed and its weight subtracted from the live-weight to find the empty weight. The carcass was dissected into meat, and bone and tendons.

All the meat was then reduced to pulp in a rotating bowl provided with revolving knives; an aliquot part was then taken for analysis. The internal organs to which the blood had been added were treated in the same way. The wool was shorn from the dried skin, weighed, sampled and analyzed. The skin and hoofs were also weighed, sampled and analyzed. The bones and tendons were first cut up in a bone cutter, and then finely ground, sampled and analyzed. The results obtained for the first and last pairs of sheep are set out in Tables III and IV respectively.

TABLE III

SHEEP KILLED NOVEMBER 10, 1924. EMPTY WEIGHT 29·25 KILO = 64·35 LB.

	Weight kilo	Percentages		Weights, kilo	
		Protein	Fat	Protein	Fat
Meat	12·600	13·33	20·06	1·68	2·53
Bones, etc. ..	3·954	19·87	13·99	·79	·55
Offals	7·360	13·50	9·16	·99	·67
Wool	2·078	70·00	10·00	1·45	·21
Skin, etc. ..	·769	71·66	9·88	·55	·05
				5·46	4·04

Percentages in Empty Weight: Protein, 18·7,
Fat, 13·8.

SHEEP KILLED NOVEMBER 10, 1924. EMPTY WEIGHT, 27·299 KILO= 60·06 LB.

	Weight kilo	Percentages		Weights, kilo	
		Protein	Fat	Protein	Fat
Meat	12·508	15·90	16·93	1·99	2·12
Bones, etc. ..	3·456	18·55	16·32	·64	·56
Offals	7·128	12·44	12·09	·89	·86
Wool	1·361	72·67	10·00	·99	·14
Skin, etc. ..	·742	63·69	19·18	·47	·14
				4·98	3·82

Percentages in Empty Weight : Protein, 18·2.
Fat, 14·0.

Means of the first pair of animals :—
Percentages in Empty Weight : Protein, 18·45.
Fat, 13·9.

Mean live-weight, 83 lb. ; mean empty weight, 62·2 lb.
Mean percentages in live-weight : Protein, 13·8.
Fat, 10·4.

TABLE IV

SHEEP KILLED MARCH 12, 1925. EMPTY WEIGHT, 48·39 KILO= 106·4 LB.

	Weight kilo	Percentages		Weights, kilo	
		Protein	Fat	Protein	Fat
Meat	23·20	14·64	34·63	3·90	8·10
Bones, etc. ..	5·40	17·97	14·45	·97	·78
Offals	10·75	10·21	28·00	1·10	3·00
Wool	2·96	70·00	10·00	2·07	·30
Skin, etc. ..	1·23	63·94	18·50	·78	·23
				8·82	12·41

Percentage in Empty Weight : Protein, 18·3.
Fat, 25·7.

SHEEP KILLED MARCH 12, 1925. EMPTY WEIGHT, 46·97 KILO= 103·3 LB.

	Weight kilo	Percentages		Weights, kilo	
		Protein	Fat	Protein	Fat
Meat	22·20	13·58	35·98	3·01	7·97
Bones, etc. ..	5·20	12·74	21·45	·66	1·12
Offals	10·87	9·56	30·56	1·04	3·32
Wool	3·32	74·14	7·36	2·46	·25
Skin, etc. ..	1·36	63·00	20·67	·86	·28
				8·03	12·94

Percentages in empty weight: Protein, 17·2.
Fat, 27·6.

Means of second pair of animals :—

Percentages in empty weight: Protein, 17·75.
Fat, 26·65.

Mean live-weight, 125 lb.; mean empty weight, 104·8 lb.
Mean percentages in live-weight: Protein, 14·9.
Fat, 22·4.

The average live-weight of the whole lot of sheep on November 10 was 87 lb., and on March 12, 124 lb. Applying to these figures the mean percentages of protein and fat in the live-weight of the animals killed on these dates after selection as typical animals, the weight of protein and fat in typical animals on these dates were :—

On November 10 .. $87 \times 13{\cdot}8 \div 100 = 12{\cdot}00$ lb. protein.
$87 \times 10{\cdot}4 \div 100 = 9{\cdot}05$ lb. fat.
On March 12 .. $124 \times 14{\cdot}9 \div 100 = 18{\cdot}50$ lb. protein.
$124 \times 22{\cdot}4 \div 100 = 27{\cdot}80$ lb. fat.

Live-weight increase containing the differences between these weights, $124 - 87 = 37$ lb. The percentage composition of this live-weight increase was therefore :—

Percentage composition of live-weight increase:	
Protein	17·6
Fat	50·7
Water (and ash)	31·7
	100·0

The heat of combustion of sheep protein is very nearly 5·7 calories per gramme, or 2,600 calories per lb.; of sheep fat, 9·5 calories per gramme, or 4,300 calories per lb. The calorie value of live-weight increase per lb. is therefore :—

Calories per lb. live-weight increase :

Protein ..	$17{\cdot}6 \times 2{,}600 \div 100 =$	458 calories.
Fat ..	$50{\cdot}7 \times 4{,}300 \div 100 =$	2,180 ,,
		2,638 ,,

This figure is equivalent to $2{,}638 \div 1{,}070 = 2{\cdot}47$ lb. starch equivalent, a figure which is in excellent agreement with those found for the production requirement by other methods. It applies to the second, third, fourth, and fifth months of fattening, the middle of which period is the end of the third month.

Summarizing all the figures given above, it appears that the best average round figure to take for the production requirement of fattening sheep is 2½ lb. of starch equivalent per lb. of live-weight increase. There are clear indications that in the early stages of fattening, especially with young animals, 2 lb. of starch equivalent will make 1 lb. of increase, whilst in the later stages of fattening 1 lb. of increase may require over 3 lb. of starch equivalent. By rationing on the basis of the suggested average figure, the rate of increase obtained in the early stages may be expected to exceed, and, in the later stages, to fall short of, the rate aimed at.

Summary and Conclusion.—Although this paper appears under the writer's name alone, he wishes it to be distinctly understood that it represents a piece of team work by members of the staff of the School of Agriculture and others. He has already recorded his indebtedness to Mr. P. E. Graves for many of the statistical calculations. He takes this opportunity of thanking the following gentlemen for assistance in other directions : Mr. C. Heigham, late Director of the Norfolk Agricultural Station, now Farm Director of the Rothamsted Experimental Station ; Mr. F. Rayns, Director, and Mr. S. T. Johnston, Assistant Director, Norfolk Agricultural Station, and Mr. W. J. Winn, Steward of the Saxlingham Farm, for supervision and weighing of the animals and the feeding stuffs used in the Saxlingham experiments ; Colonel W. A. Wood, C.B.E., M.R.C.V.S., Mr. L. F. Newman and others for dissection of the carcasses and preparation of the samples ; and Messrs. A. J. Codling, the late C. Bryant and others for analyses of the samples in the comparative slaughter experiment ; and Mr. E. T. Halnan and others for assistance in looking up references and reading proofs.

The writer claims that the investigation taken as a whole has demonstrated the following points :—

(1) That in the case of a very large proportion of the feeding trials with sheep recorded in British agricultural literature, the rations credited to the animals are impossible, the dry matter consumption being in many cases far below standard requirements.

(2) That in the case of all recorded trials where the dry matter consumption was reasonably near normal, live-weight increase was produced at the average rate of 2·3 lb. of starch equivalent per lb. of increase.

(3) That in a series of specially designed trials, in which large numbers of sheep were used, live-weight increase was produced at the average rate of 2·5 lb. of starch equivalent per lb. of increase.

(4) That the average production requirement, calculated from a series of comparative slaughter experiments on the basis of 1,070 calories per lb. of starch equivalent, is 2·88 lb. of starch equivalent per lb. of live-weight increase, the average figure being rather high because the series included several cases of extreme fattening.

(5) That a comparative slaughter experiment, recently carried out at Cambridge, gives a production requirement of 2·47 lb. of starch equivalent per lb. of live-weight increase.

(6) That the practical identity of the figures obtained by calculation from feeding trials by the formula $x=(R-M)\div G$, and from comparative slaughter experiments, on the basis of 1,070 calories per lb. of starch equivalent, is a striking confirmation (*a*) of the correctness of the maintenance requirement as indicated by the curve given in Fig 1, (*b*) of the assumption that the whole of the starch equivalent in the ration is used up in maintenance and production, and (*c*) of the assumption that in the sheep, as in the bullock, 1 lb. of starch equivalent makes an amount of increase which contains 1,070 calories.

(7) That the best round figure for the production requirement of fattening sheep is $2\frac{1}{2}$ lb. of starch equivalent per lb. of live-weight increase.

(8) That the easiest, most interesting and most reliable way of computing rations for sheep is to read off the maintenance requirement from Fig. 1, which connects maintenance requirement with live-weight, and to add for production at the rate of $2\frac{1}{2}$ lb. of starch equivalent for each pound of live-weight increase which it is desired to produce.

(9) That a ration computed in this manner will, in the first stages of fattening, produce rather more than the desired increase, and in the last stages rather less.

Finally, it should be pointed out that the desired rate of increase will only be realized if the animals are contented and comfortable, so that they do not use up an abnormal amount of starch equivalent in unnecessary movements.

* * * * * *

AGRICULTURE AND THE INTERNATIONAL ECONOMIC CONFERENCE

THE International Economic Conference held under the auspices of the League of Nations, which met at Geneva on May 4, concluded its session on Monday, May 23, when it adopted its final report.

As is well known, this Conference met to consider the general economic situation of the world. Representatives of fifty nations took part in its deliberations, and the report issued as a result of the Conference indicates the vast and complex problems with which it had to deal. A feature of great importance was that, for the first time in a Conference of this character, agriculture has been represented side by side with commerce and industry; this alone gave emphasis to

the fundamental importance of agriculture in the general economic prosperity of the world.

The work of the Conference was divided between three main Committees—Commerce, Industry, and Agriculture—and the Final Report includes those prepared by each of these Committees and adopted by the Conference as a whole. The section of the Report dealing with agriculture, and the documentation prepared for the Conference, bring out clearly the fact that a widespread agricultural depression exists, not universal and not of equal severity between one country and another, but affecting a large number of those countries from which the world's supply of food and raw materials is obtained. The causes of this depression are complex, and the documents of the Conference made it evident that they differ very considerably between one country and another. For example, in those countries where there was a severe post-war inflation, the working capital employed in agriculture almost completely disappeared and the cost of obtaining credit rose to nearly prohibitive figures. Again, the taxation borne by agriculturists had, in some cases, risen to as much as three times its pre-war value. Another factor of great importance was the change in the political and economic frontiers in Central Europe. The old Austro-Hungarian Empire, for example, has been split up into a number of separate states, each of which attempted to pursue a policy of self-sufficiency, protecting its own industries by high tariffs, but increasing thereby the difficulties of exchanging agricultural and industrial products between these countries. A fourth factor was the great diminution in the stream of agricultural produce which, before the war, flowed westward from Russia and the Danubian countries, and consequently in the counter stream of industrial products from west to east. Where, formerly, Europe had drawn its supplies of foodstuffs so largely from these countries, it now looked to the United States, Canada and elsewhere.

All these facts and many others are shown, by the documents of the Conference, to have profoundly affected the world's agriculture, but not its agriculture alone, for the causes of agricultural depression were largely the same as those which operated against a revival of European industry and commerce. Perhaps the most significant feature of the section of the Report dealing with agriculture is the realisation of the essential inter-dependence of agriculture, industry and commerce; in the words of the Report, "it would be vain to

hope that one could enjoy lasting prosperity without the others."

The broad fact upon which the Report lays emphasis as a symptom of economic depression in agriculture, is the relatively lower level of agricultural prices, as compared with industrial prices, which is shown by the index numbers of several countries. The result has been the diminution of the purchasing power of the agricultural population. Although not true of all countries, "the documentation of the Conference," to use the words of the introduction to the Final Report, "indicates that if agricultural prices are low and the agricultural communities in many countries in a state of depression, it is not because there has been any abnormal increase in the production of foodstuffs, but because the demand from certain manufacturing communities in Europe is inadequate."

The Agricultural Report, the text of which is given below, necessarily represents an attempt to embody a great number of divergent points of view. Practically all of the 50 countries taking part in the Conference were interested in agriculture, but, not unnaturally, the outlook of the delegates from the various nations depended first of all on the national problem which confronted them, which differed very widely between one country and another. Nevertheless, bearing in mind what has been mentioned above, it will be seen that the Report, in effect, indicates two main directions in which an agricultural revival must be sought. One lies in the improved demand which would be created by an expansion of industry and commerce, and although the main recommendations of the Conference on the subject of trade barriers are contained in the section of the Report dealing with Commerce and not in that relating to Agriculture, nevertheless the recommendations of the latter concerning the removal of all hindrances to the free circulation of and trade in agricultural products, to the reduction of customs prohibitions both for industry and agriculture, and to the abolition of systems of export prohibitions and duties and of frequent changes in customs tariffs, are some indication of the importance which the Agricultural Committee attached to these matters.

The other direction in which improvement is to be sought is in raising the standard of agricultural technique, and the majority of recommendations contained in the Report are concerned with this subject. They relate to the extension of co-operation—particularly between producers' and consumers' organizations—to the improvement of credit facilities, to

international co-operation in providing statistical information and in the development of systems of farm accounting, and also to the development of forestry and colonial agriculture. Not the least important is the recommendation relating to an international campaign to combat plant and animal diseases, in connection with which the International Institute of Agriculture in Rome are proposing to call a further conference. In addition to the above, the Report makes certain recommendations in regard to the application of legislation to agricultural workers, and calls attention to the importance of improvement in stock breeding, marketing and the standardization of agricultural products. The full text of the Report of the Agricultural Committee is as follows :—

* * * * * *

INTERNATIONAL ECONOMIC CONFERENCE

6. AGRICULTURE.

1. Introduction.—Agriculture is the occupation of the majority of workers throughout the world ; its various products represent in value the greater part of human labour, and the exchange of its products against industrial products forms, indeed, the basis of world trade.

The agricultural population remains for humanity a reservoir of energy capable of preserving the nations from the rapid human wastage which may result from any excessive growth of industry.

The quantity of foodstuffs and raw materials produced by agriculture is one of the factors which determine the maximum limit of industrial development.

The interdependence existing between nations is no less close between the main classes of occupations—agriculture, industry, and commerce —and it would be vain to hope that one class could enjoy lasting prosperity independently of the others.

Agriculture is at present hampered in the complete fulfilment of the economic role assigned to it by a general depression varying in degree but affecting a large number of countries on which the world depends for its supply of foodstuffs and raw materials.

The economic depression in agriculture is characterized by the disequilibrium which has arisen between the prices of agricultural products and those of manufactured products ; as a result, agriculturists in a great number of countries no longer receive a sufficient return for their labour and on their capital. This depression is aggravated in many countries by the difficulty of obtaining credit on normal terms and by the great increase in fiscal charges ; while it has led to a decrease in the purchasing power of agriculturists, consumers have not, in all cases, benefited by a fall in the price of foodstuffs.

The diminution in the purchasing power of the agricultural population has reacted upon industrial production, and is consequently one of the causes of unemployment, which in its turn reduces the outlets for agricultural products.

Unless practical measures are taken to restore the price equilibrium, it is to be feared that sooner or later there will be a diminution in agricultural production detrimental to the welfare of mankind.

Technical means exist, however, for a considerable development of agricultural production. They must therefore be put into operation. Their general adoption would have the most beneficial consequences for the prosperity and economic peace of the world.

II. General Resolutions.– (1) The Conference regards as a vital economic question the increase of agricultural production, and, with this in view, the placing of agriculture on an equal footing with industry by enabling all those engaged in agriculture to obtain a satisfactory standard of living and a normal return for their labour and on their capital.

It is important that this necessity should be brought home to public opinion, which does not always realize the true situation of agriculture and too often regards it as an industry of secondary importance.

(2) The improvement of agriculture must in the first place be the work of the agriculturists themselves. The general adoption of technical improvements, the scientific organization of production and stock-breeding, of the campaign against the diseases and the enemies of plants and animals, of marketing, of the standardization of agricultural products in the interests both of the producers and consumers, of the search for outlets, and of credits and insurance, will permit agriculturists to reduce their costs of production in their own interests and to the benefit of consumers.

Owing to the considerable number of small and medium-sized agricultural undertakings—the tendency towards concentration displayed in industry being absent—the organization of agriculturists should be continued along the lines of association and co-operation which have already been tested in many countries; it may with advantage be supplemented by agreements between agricultural and consumers' co-operative societies.

It is to the interest of Governments to encourage agriculture and the agricultural associations which have as their object the improvement of the situation of the agricultural population. In particular, the creation and development of mutual credit would be greatly facilitated by Government assistance.

The Conference draws the attention of the Governments to the fact that high rates of interest and heavy taxation hamper production.

(3) Other measures to be contemplated depend chiefly on legislative action. In particular, the Conference is of opinion that social laws ensuring the welfare and security of workers should benefit agriculturists no less than industrial workers and employees, it being understood that such laws must be adapted to the special requirements of agriculture and to the special living and working conditions of rural populations. It is also of the opinion that agricultural instruction at all stages and the technical training of agriculturists should receive the attention of the different Governments as well as of agricultural associations.

(4) It is desirable that all hindrances to the free circulation of and trade in agricultural products should be removed, in so far as their removal does not endanger the vital interests of the different countries and their workers.

In those States in which Customs protection is maintained, it should be reduced, both for industry and agriculture, to the lowest possible point indispensable to production; care should be taken to assist in the maintenance of an equitable balance between industry and agriculture and not to stifle one to the advantage of the other.

The system of export prohibitions and export duties (with the exception of taxes levied for the benefit of the industry concerned)

and frequent changes in Customs tariffs, which long experience has shown to be ineffectual and dangerous, should be definitely abandoned.

(5) The agriculturist should find his just remuneration not through speculation but in the regularity of prices, permitting him to reckon on a legitimate return equivalent to that accorded to other producers.

(6) Since, finally, the policy pursued in industrial or commercial questions reacts on the economic situation of agriculture, and *vice versa*, the Conference requests the League of Nations to ensure that in all its organizations already existing or to be formed which are or may be entrusted with economic questions a place be always reserved for agriculture proportionate to its importance as a social and economic factor.

III. Special Resolutions.—In addition to the general resolutions formulated above, the Conference draws the attention of the League of Nations to the following points :—

1. *Agricultural Co-operation : Relations between Agricultural Co-operative Societies and Consumers' Co-operative Societies.*—(i) The agriculturists of the different countries contribute to the improvement of their standard of living and to the general prosperity by utilizing to an increasing extent all forms of co-operation : co-operative supply societies, either for the technical or domestic requirements of members ; co-operative selling organizations for the regular marketing of products ; producers' co-operative societies for the intermediate processes between the production of the raw material and the sale of the finished product ; co-operative credit societies to meet the need for capital (bringing equipment up to date, improving the cultivation of the soil, storage of products).

Co-operative institutions thus increase the purchasing power of agriculturists both as producers and as consumers. At the same time they further economic progress both by increasing productivity and improving quality and also by making it possible to utilize fully the products of the soil and their by-products. Lastly, they assist the organization of markets by methods which reduce to a minimum the costs of distribution.

(ii) Agricultural co-operative societies will contribute to a still greater rationalization of economic life in proportion as they develop their relations with the consumers' co-operative societies. Direct commercial relations between producers and consumers, and between associations of producers and of consumers, eliminate superfluous intermediaries, and, when they are sufficiently widespread, result in the establishment of prices which are advantageous to both parties. In addition to material profit, there is a moral advantage ; by direct commercial relations producers and consumers learn to know each other and to take account of the special characteristics and requirements of the other party. The producers' and consumers' co-operative societies learn to appreciate the value of direct relations in accordance with their common principles. The clear realization of the possibility of mutual collaboration and mutual confidence in business transactions are essential to a practical solution of the question of direct commercial relations between producers' agricultural co-operative societies and consumers' co-operative societies—a question which has for a long time past been settled in theory.

The efforts made to achieve practical results should be furthered on the part of agriculture by the production of articles of specific quality and uniform type ; on the part of the consumers' co-operative societies by the determination to buy agricultural produce as far as possible from the agricultural producers' co-operative societies ; on

the part of States and of public authorities by supporting the co-operative movement through the creation of chairs at universities or of other scientific institutions, the institution of public courses dealing with the co-operative movement, and by a fiscal policy of abstention from discriminatory measures against co-operative societies.

Effective collaboration, if need be in the form of common undertakings, will be the easier of realization if the producers' and consumers' co-operative societies of the different countries are already nationally organized in common economic committees.

To ensure the normal development of co-operation in all the branches in which it exercises its activities, it is extremely important that the laws which govern co-operation should be unified where such is not yet the case, and should impose the fewest possible obstacles.

(iii) International agreements between co-operative agricultural organizations with regard to a number of products might be of value in placing markets on a sound basis, in regularizing production and in stabilizing prices at levels satisfactory from the point of view of the balance between production and consumption. Such international agreements, to attain their aims, require loyal collaboration with the national and international co-operative consumers' organizations by the establishment of regular business channels and long-term contracts.

(iv) These efforts of agricultural and consumers' co-operative organizations should be encouraged and furthered by the creation of a committee representing national and international co-operative organizations of agriculturists and of consumers—a committee which should be entrusted with the establishment of a programme of research and documentation, as well as with the task of elucidating the lessons taught by past experience, with a view to bringing about new achievements.

2. *Agricultural Credit.*—The increase of agricultural production is intimately bound up with the organization of agricultural credit, which will place at the disposal of agriculturists the necessary capital on favourable terms.

Certain countries have at their disposal sufficient capital for agriculture, but in many countries adequate provision for agricultural credit has not as yet been made, either because saving has been diminished by the general economic conditions or because the appropriate organizations have not yet been constituted.

Such a position is seriously harmful to agriculture in the countries in question, since it prevents agriculturists from increasing their harvests, from exploiting their land to the full extent, from securing lower costs of production and from providing for contingencies arising from the very nature of agricultural production by the use of suitable equipment or of a reserve working capital.

The first condition for surmounting these difficulties is the organization of suitable credit institutions in those countries where they do not yet exist and their development where they are already in existence. The best form of institution appears to be the co-operative credit society operating by means of resources which the very fact of association enables it to procure and to increase with or without the assistance of the public authorities.

It is, moreover, by the co-operation of national organizations that the necessary effective guarantees for appeals for credit, whether national or international, can be most easily procured.

Having had laid before it by several of its members schemes with regard to the setting up of an international organization capable of increasing the resources available for agricultural credits where they are as yet insufficient;

But having heard observations on that question based chiefly on the elementary consideration that credit must be secured by effective guarantees ;

And being aware of the fact that the International Institute of Agriculture is collecting special information on the question of agricultural credits :

The Conference requests the League of Nations to give full consideration to the documentation of the International Institute of Agriculture with a view to examining the possibility of international collaboration in respect of agricultural credits in whatever form may be found from experience to be most suitable with a view to promoting the recovery of agriculture where agriculture is short of capital.

3. *Campaign against the Diseases Affecting Plants and Animals.*—Diseases which affect plants and animals diminish agricultural production, and should be scientifically combated, on the basis of an international plan and international agreements.

This international campaign has already been admitted in principle by 43 nations, which have set up an "International Epizootic Office," and the International Institute of Agriculture is proposing to convene a special conference to bring about united international action in connexion with phytopathology.

International agreements which establish sanitary supervision, if they provide the contracting countries with adequate guarantees, should, without infringing sovereign rights, remove from the regulations any suspicion of disguised protection, and should add to the stability of trade relations, which is one of the conditions of successful production.

4. *Agriculture in Colonies.*—The Conference recommends that an investigation be made into the best means of encouraging agriculture among the indigenous inhabitants in colonies, and especially in tropical and sub-tropical colonies, in order to augment the prosperity of the indigenous inhabitants of those countries and to increase the general wealth.

5. *Forestry.*—The Conference recommends that a special study should be made of the resources and the exploitation of forests in order to assure the regular satisfaction of the needs of industry.

6. *Documentation on Agricultural Questions.—Statistics.—Inquiry.*—(i) Great as is the value of the documentation which has served as the basis for the discussions on agriculture, it must be acknowledged that there is not yet a sufficient foundation to permit of a complete analysis of all the problems or to suggest a solution of them.

The fundamental importance of agriculture demands an exact knowledge of its economic situation. Such knowledge can only be gained satisfactorily through a methodical analysis of farm accounts. Such researches would bring about a general improvement in agriculture. They would facilitate the mutual understanding between the nations, and the common interests of the agriculturists of all countries would thereby be interpreted with precision. Finally, a better understanding would be created between the producer and the consumer.

To achieve this purpose, it is desirable that in the different countries an exact system of farm accounting should be formulated. These accounts should be drawn up in every country as simply as possible, but by the method ensuring the greatest guarantee of accuracy, so as to obtain comparable results for the different kinds of agricultural enterprises in any country, classified by climate, nature of soil, size of holding, systems of cultivation, principal crops grown, etc., and so as to make it possible to study the influence exerted on the net return of agriculture by the factors of greatest importance in production and returns (wages,

quantities of chemical fertilizers consumed, taxation and social charges, prices, indebtedness of agriculturists, etc.).

It is therefore recommended that a committee of experts be established charged with the study and preparation of the requisite measures.

(ii) The Conference considers it necessary that a better service of periodical agricultural statistics should be instituted, especially as regards live stock and animal products. The data collected by the International Institute of Agriculture show that, during the last 25 years, only 37 countries, representing less than half the total area and about 30 per cent. of the population of the world, have as yet proceeded to the compilation of an agricultural census.

A world agricultural census on the lines proposed by the International Institute of Agriculture would make it possible to give to the statistical data of the different countries a character of uniformity which up to the present they have lacked.

It is no less necessary to organize, nationally and internationally, the speedy transmission to agriculturists of information on harvests, stocks, consumption, and the movements of different commodities, these being important factors in the formation of prices. The monthly publication of indices of comparative prices of agricultural products and industrial products would prove of great value, as would indices of the principal elements of the costs of production of agricultural products.

(iii) The Conference requests that all Governments should be invited to initiate a general inquiry into the present situation and the possibilities of developing agriculture, the distribution of holdings and the systems of exploitation, into the relations between agricultural and industrial production, into the comparison between agricultural and industrial prices, into the costs of production and selling prices, into the condition of the workers and into the facilities required for their access to the land, etc.—in fact, into the economic, social, financial and technical conditions of agriculture, the study of which will permit further progress to be made.

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MARKETING DEMONSTRATIONS AT AGRICULTURAL SHOWS

IN this JOURNAL for April last (p. 8) were given particulars of the shows at which the Ministry proposed to demonstrate improved methods of marketing during the present summer. During May, demonstrations were given at the Oxfordshire Show (May 18-19) and at the Bath and West and Southern Counties Show (May 24-29). At the former show, the demonstration was limited to eggs and poultry; at the latter, the demonstration covered the marketing of eggs, poultry, fruit, pigs and pig products. During June, demonstrations were given at the Suffolk Show at Ipswich (June 2-3), Three Counties Show at Worcester (June 7-9), Royal Cornwall Show at Truro (June 8-9), and the Lincolnshire Show at Spalding (June 22-24). With the exception of the Three Counties Show, the demonstrations during June related to egg and poultry marketing. The demonstration at the Three Counties Show related to fruit.

The demonstrations proved very attractive and seem to have been much appreciated; the large numbers of visitors who passed through showed considerable interest. Leaflets explaining the object and scope of the demonstrations and the special marketing leaflets issued by the Ministry were in great demand; over a thousand copies of the marketing reports in the Ministry's Economic Series were sold. H.R.H. The Prince of Wales honoured the demonstration at Truro with a personal visit. The Imperial Economic Committee, the Royal Commission on Agriculture in India (of which Lord Linlithgow is Chairman) and representatives of the Standing Committee appointed under the Merchandise Marks Act, 1926, made special journeys from London to see the demonstrations at Bath, which were also visited by the Minister.

The following is an outline of the demonstrations, the main features of which were fully explained to visitors by a series of posters.

Marketing of Eggs.—*The Care of Eggs.*—The perishable nature of eggs is not sufficiently realised. Attention was, therefore, drawn in various ways to the importance of the care of eggs from the moment they are laid. Absolute cleanliness is essential. Dirt on the shell not only detracts from the appearance but may contaminate the contents, particularly if moisture is present when mould growths may develop inside the shell and give a musty flavour. The shell of an egg is porous and the contents evaporate at a variable rate according to the thickness of the shell and the conditions under which the eggs are kept. Further, it follows from the porous nature of the shell, that eggs are likely to become tainted and their flavour impaired when placed near strong-smelling goods.

Sale of Eggs by Weight.—The sale of eggs by weight is now compulsory in Northern Ireland. The procedure is simple, but it is an innovation so far as England and Wales are concerned and an endeavour was made, in various ways, to illustrate its advantages. Wholesale transactions on the basis of weight are fairer to all concerned than sale by count.

Candling.—The object of the "candling" exhibit was to afford ocular demonstration of the blemishes and wide variations in quality frequently met with in eggs, and, further, to illustrate methods of testing which are indispensable to the distributive trades. It is not suggested that producers who pay due attention to the collection and storage of eggs should necessarily candle all their supplies. Candling should, however, be undertaken by distributors as a routine safeguard to their business.

Grading.—Grading is essential if eggs from the surplus-producing areas of England and Wales are to take their rightful place in the large consuming centres. The chief advantage which the foreigner possesses in our markets is the fact that foreign eggs are uniformly graded according to a definite system and can safely be bought on description. Home-produced eggs must therefore be put in a position to carry a similar guarantee of reliability. It is not, however, sufficient that they should be graded according to the theories of this sender or that. What is required commercially is not a multitude of grading systems, but one system of grading for both size and quality that is so widely recognized and practised that the grades become, in effect, *national standards*. A display of home-produced eggs graded in accordance with the standards proposed by the Ministry was on view; in addition, commercial samples of imported eggs were shown to illustrate the nature of the competition which confronts the home producer. Of special significance was the display of well-graded eggs from Northern Ireland and the Irish Free State, which showed what legislation can do for the producer in the direction of better marketing. Until recently, no mechanical means of egg grading suitable for general adoption had been evolved, but a mechanical egg grader was exhibited of a type which is now largely used in Ireland, and attracted much attention.

Packing.—Packages should weigh as little as possible consistent with adequate strength, should be easily packed and unpacked, and should be designed not only to show their contents to the best advantage but to withstand severe handling in transit. Care should be taken to use only clean packages and clean, dry, non-odorous packing material; this is of special importance for eggs that are destined for the cold-store (*see* later), when a well-ventilated package is also essential. Finally the branding of cases with the name of the consignor and an accurate description of the contents is an effective advertisement. These considerations were brought out in the exhibit. Of particular interest were two designs for brands, one for use by local organisations of packers and the other for use as a national mark. Some of the packages in use for imported supplies were to be seen in the exhibit of packed eggs from Dominion and foreign sources. Specimen standard non-returnable boxes, as recommended for home-produced eggs by the Committee* recently set up by the Ministry for

* *See* this JOURNAL, June, 1927.

that purpose, were on view, also examples of packing materials.

Organization.—Large producers are, themselves, in a position to grade their eggs before sale and many of them do so, but, as a rule, the supplies of any given area can be most efficiently and economically tested, graded and packed, when concentrated locally at specialist packing stations for the purpose. This also ensures regular and economical consignment. Packing stations need not be co-operative, but if, in any area of surplus production, existing facilities are insufficient, or inefficient, or both, it may be desirable for producers to combine to establish packing stations for themselves. By means of a diorama, an attempt was made to illustrate the "packing station" idea; packing stations lead, through standard grades and packages, to a national brand or trade mark (see above), and so to national advertising.

Marketing of Poultry.—*The Right Stages at which to Market Fowls.*—The manner in which surplus poultry is placed on the market in this country is frequently very wasteful; large numbers of fowls are sold at wholly unsuitable and unprofitable stages of development. This is sometimes due to neglect, but more often to lack of knowledge. Attention was, therefore, directed to this point by means of simple and well-chosen illustrations.

Sale by Live Weight.—A poster explained that this is a common practice for turkeys and geese, and it is customary, in some parts, for fowls and ducks. Its general adoption is desirable as bringing into prominence differences in price due to variations in quality and as being a fairer basis of sale than sale by the head.

Conditioning.—The conditioning of poultry before slaughter is of great importance and may be regarded as a ripening process. An economical method was demonstrated. Conditioning must be more generally practised than is the case to-day if the poultry trade is to develop. Specialized fattening, as carried out in Sussex, is an extension of the conditioning process.

Dressing Poultry for Market.—The methods of killing and dressing demonstrated represented the best commercial practices. Variations in the methods of dressing occur in different parts of the country, but greater uniformity is desirable and closer attention to detail.

Grading.—At present, the practice of grading is hindered by the lack of any uniform method of classifying home-produced poultry, and the time has come when some attempt should be made to introduce a standard system of classification and grading which is suited to British conditions and capable of general adoption. The commercial advantages of such a course are obvious. So far as the supplies available would allow, displays were given of the standard classes and grades which it is suggested should be applied to home-produced poultry; these sufficed to show that if producers and distributors would give their close attention to the problem, the general adoption of a standard system need not be far distant. The exhibits of poultry from the Dominions illustrated the value of efficient grading and of marketing a *standard* article. Commercial samples of graded supplies from foreign sources were also shown.

Packing.—Packing is closely linked with grading. In order to simplify grading, it is desirable to pack in comparatively small units. Distinctive types of packages for home-produced poultry are desirable, and it is necessary for greater convenience in trade that these should be non-returnable; inexpensive, standard, non-returnable packages, as recommended by the Committee referred to above, were shown. The packages in use for imported supplies were on view in the display of graded dressed poultry from Dominion and foreign countries.

Cold-Storage.—Cold-storage is of growing importance to the poultry industry. The carrying over of seasonal surpluses to meet trade demands when supplies are short is a necessary public service. The special methods of preparation and packing desirable for produce intended for cold-store are, however, neither widely known nor understood. An exhibit dealing with the cold-storage of both eggs and poultry was, therefore, arranged in conjunction with the Low Temperature Research Station at Cambridge. This conveyed much practical information of value. The chilling of dressed poultry before dispatch to distant markets is another point of importance. The small chilling plant shown was of particular interest to wholesale buyers in country districts. Serious losses are sustained in hot weather if dressed poultry arrives on the large central markets in a condition unfit for sale, through failure to chill the carcasses rapidly and adequately before packing. Preliminary chilling, immediately after killing, is also essential for supplies that are intended for transfer to distant cold-stores.

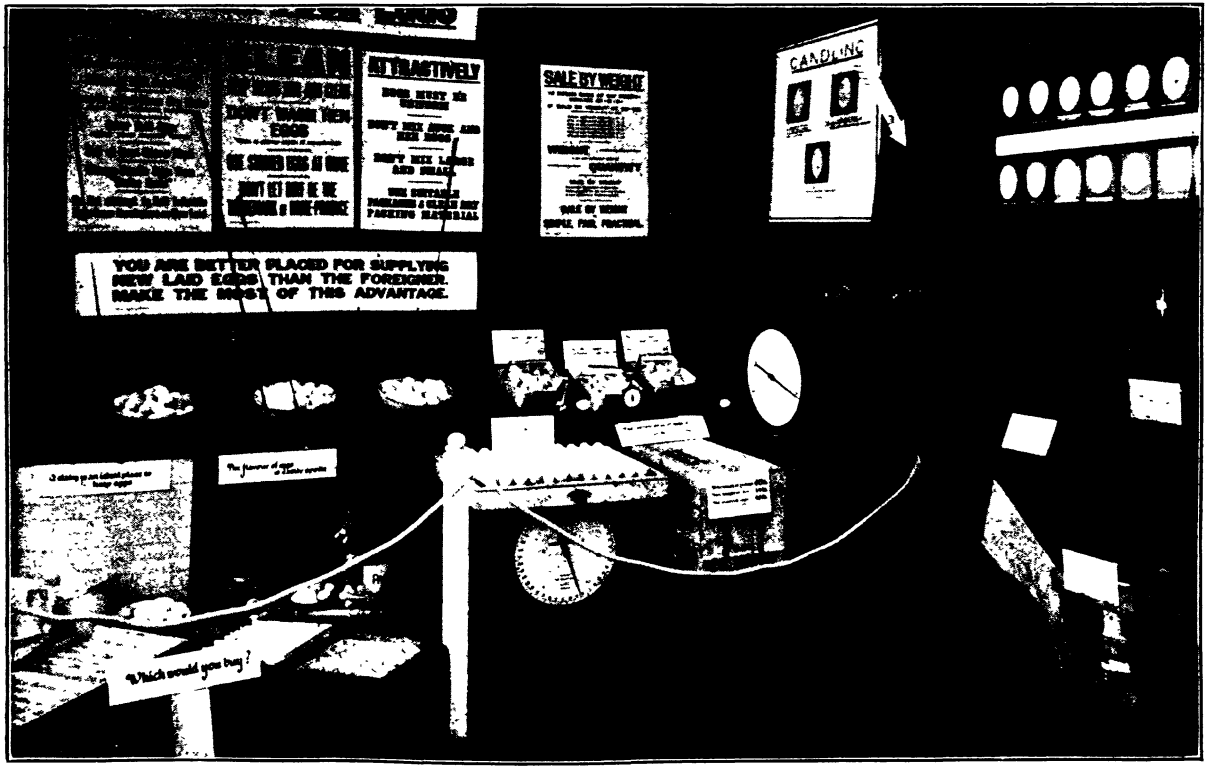
Organization.—The attention required in the final conditioning of poultry for the table is often not justified with small numbers. There would, therefore, seem to be room for many more specialist conditioning plants where birds can be assembled from local farms and markets for systematic preparation in large numbers. At such plants, birds can also, as a general rule, be more economically and efficiently dressed, graded, packed, stored, transported and sold by a specialist staff handling large quantities, than by individual producers operating independently on their own farms. In fact, standardization can hardly be achieved in any other way. As in the case of egg-packing stations, these conditioning and packing stations for poultry need not be co-operative, but if, in any area of surplus production, other agencies are insufficient or are working on too small a scale or are otherwise not up-to-date, producers may find it necessary to combine and undertake these specialist services for themselves. A diorama illustrated the " conditioning and packing station " idea. The combined conditioning and packing plant is common in America, Holland and elsewhere. Conditioning and packing stations must inevitably play an important part in marketing developments in the surplus-producing areas of this country.

Marketing of Fruit.—*Varieties.*—The factors which determine the comparative value of particular fruits are: soil and situation where best grown, cropping capacity, age at which fruiting commences, period of profitable bearing, susceptibility to attacks of pests and diseases, edible, keeping, packing and transit qualities, and popularity with consumers. A list was shown of varieties which are now established as commercially valuable and well known on the markets.

Thinning.—A well-worded poster brought out the significance of this essential market preliminary. As with vegetables and roots, fruits, such as apples and pears, must be allowed sufficient room to develop and mature. It should be borne in mind that, although thinning may reduce the total number of fruits, it increases the number of higher grades of fruit and gives fruit of more uniform size and colour; culls are reduced to the minimum. Finally, thinning prevents exhaustion of the tree in glut years and assists more regular production. The early thinnings of early varieties of cooking apples may often be profitably marketed.

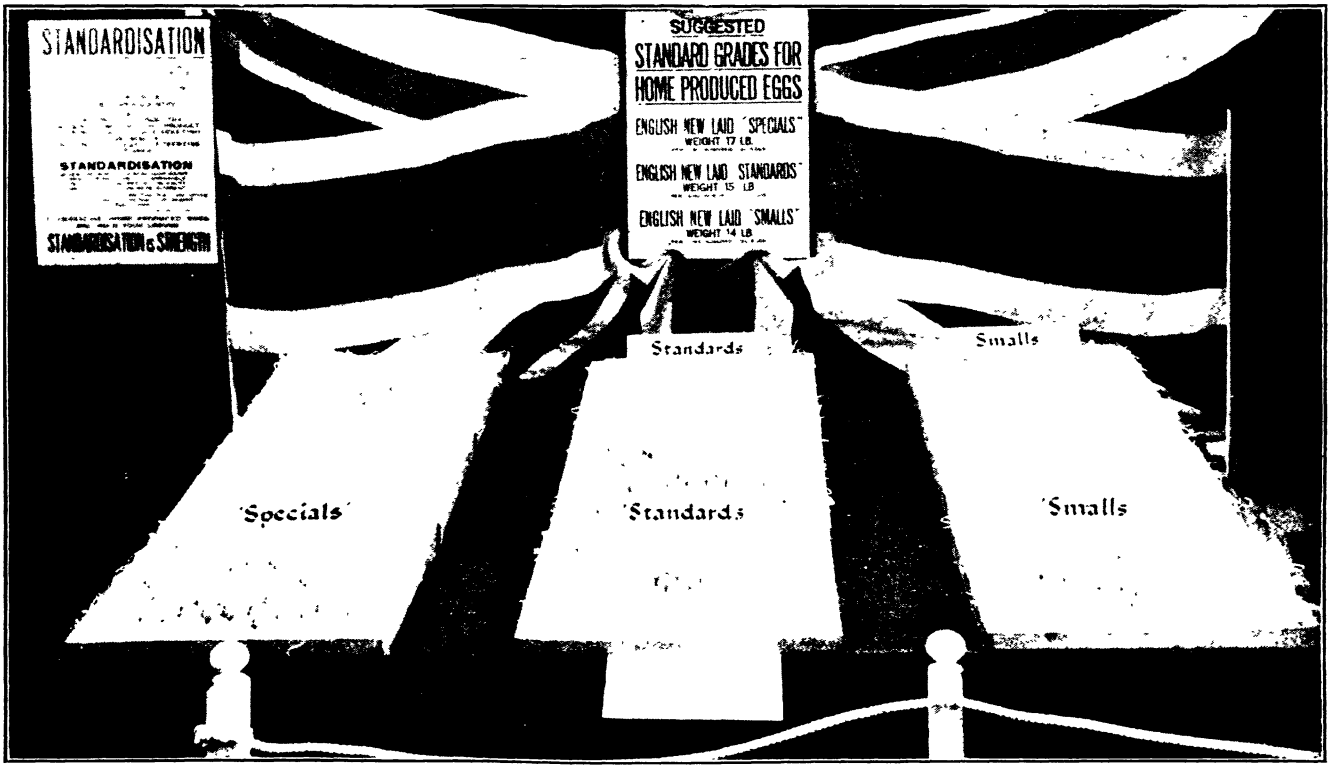
Picking.—The harvesting of the crop is a marketing operation of great importance, which often receives too little attention. In many instances, the poor and damaged appearance of

To face page 320.

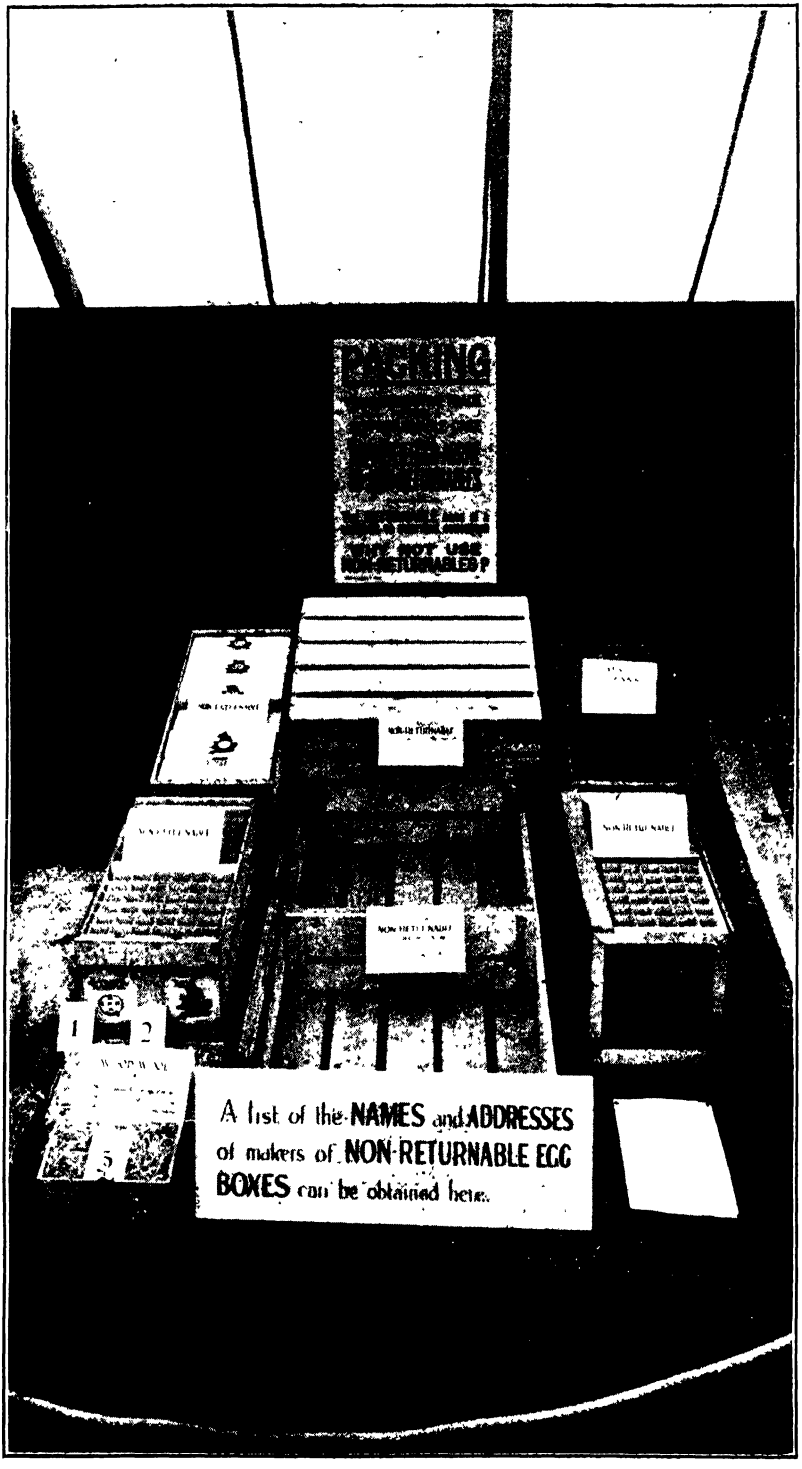

SALE BY WEIGHT
CANDLING
YOU ARE BETTER PLACED FOR SUPPLYING NEW LAID EGGS THAN THE FOREIGNER. MAKE THE MOST OF THIS ADVANTAGE.
Which would you buy?

A section of the exhibit dealing with preliminary care of eggs by producer, and sale by weight.

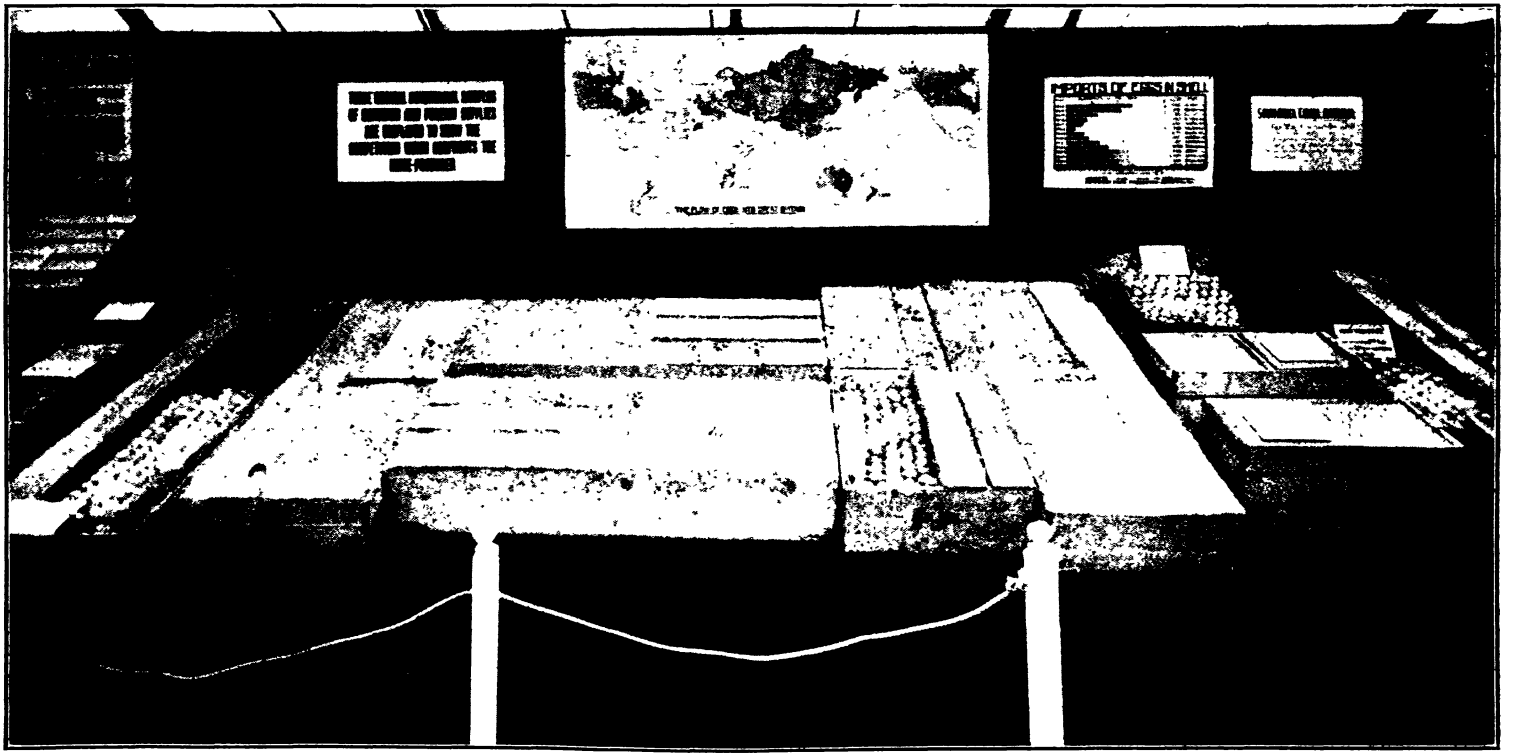
The candling, grading and packing section, showing mechanical grader and daylight tester.



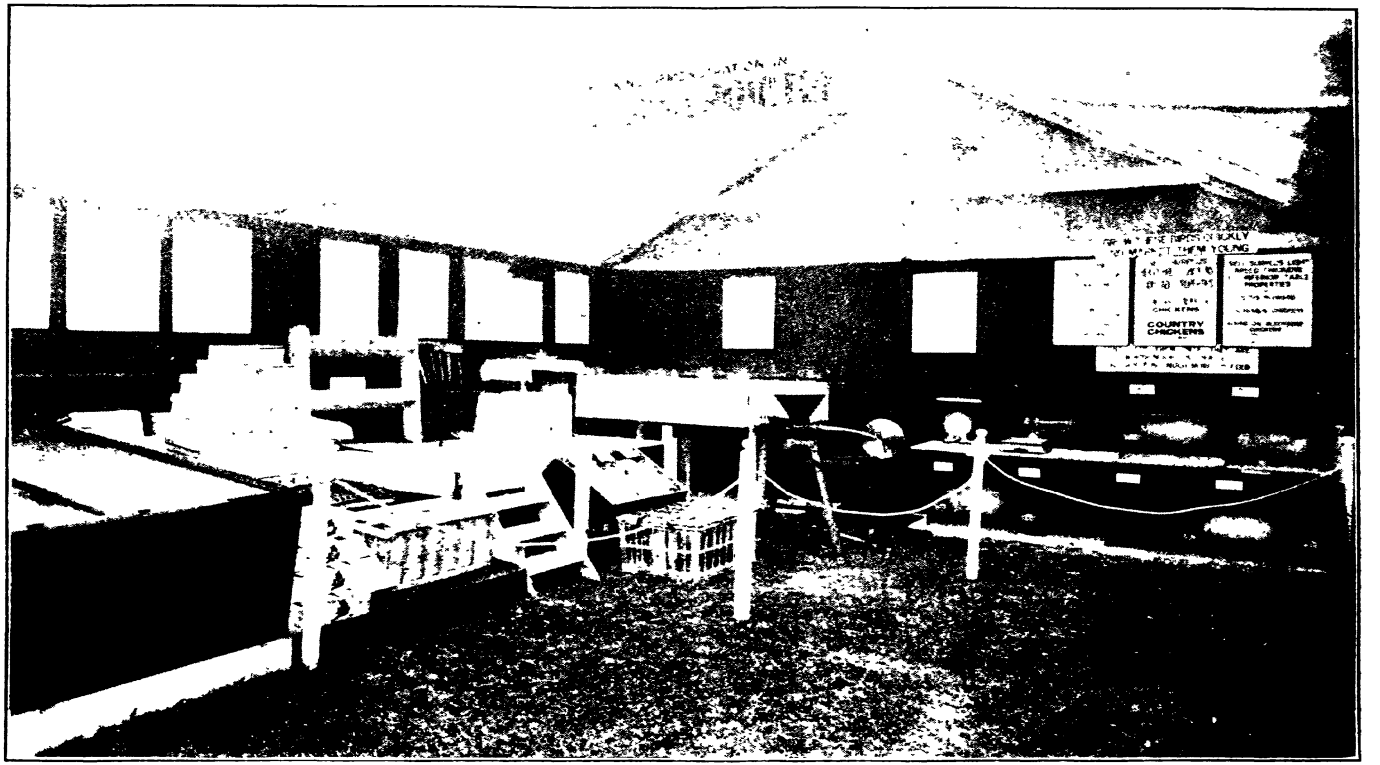
Eggs graded according to the Ministry's suggestions.



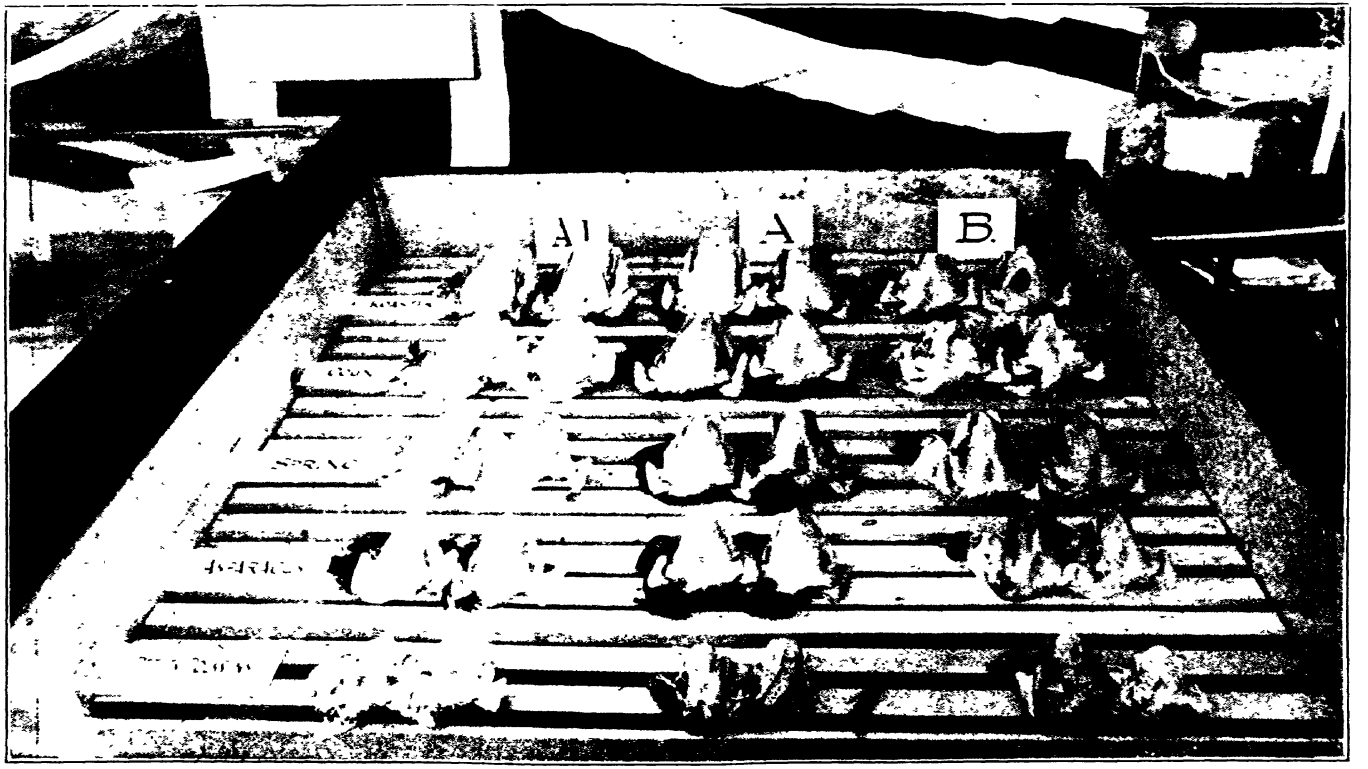
Types of egg-packages in use or recommended.



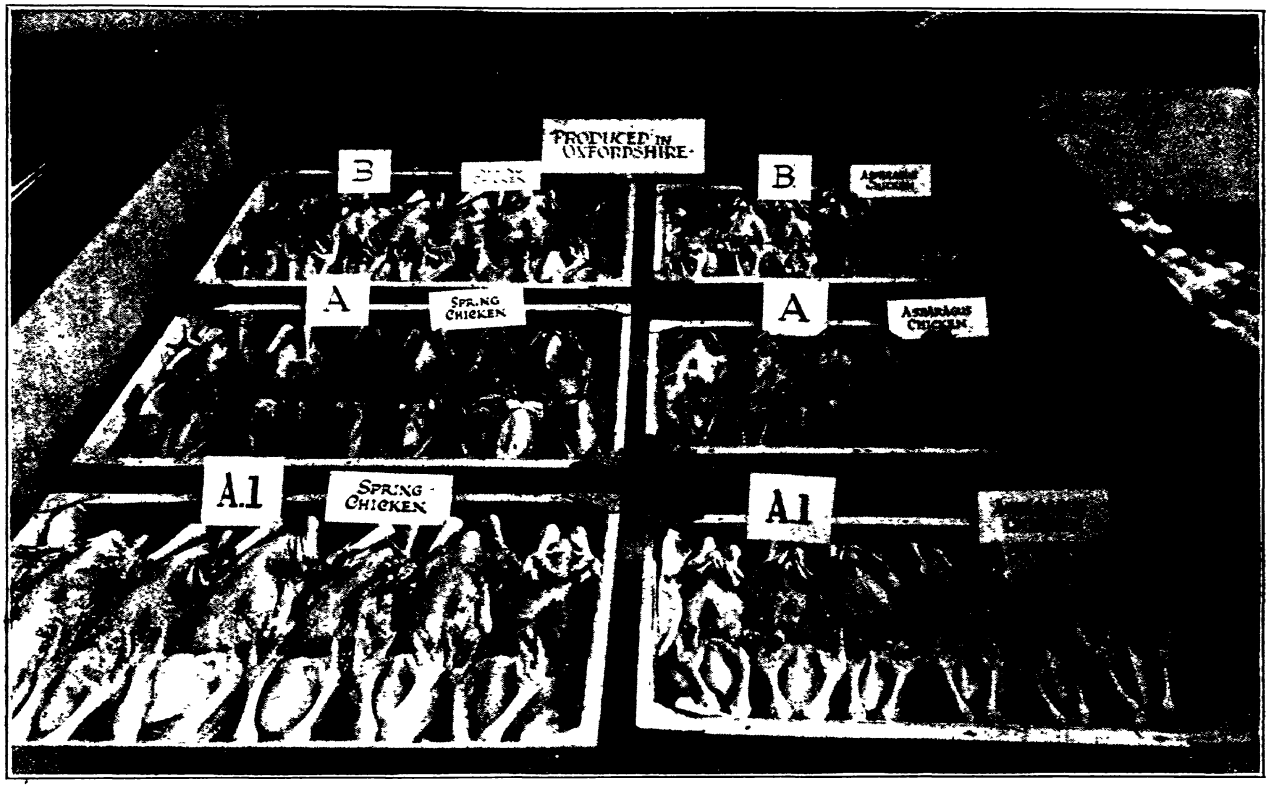
Samples of Dominion and foreign eggs.



A corner of the poultry marketing demonstration.



Fowls graded according to the Ministry's suggestions.



Specimen standard packs for home produce, as recommended by the Ministry.

graded and packed fruit as seen on the markets can be traced to rough handling in the course of picking, although the damage may not have been noticeable at the time. Injury may result from the employment of careless pickers, from lack of supervision, or from the use of unsuitable receptacles. Hard fruits more often bear evidence of careless and unskilled handling than soft fruits. Strawberries, currants, raspberries and fully-ripe soft fruits of other kinds are so obviously damageable that they are instinctively handled with greater care.

In order to avoid re-handling, soft fruits for dessert purposes are usually, and rightly, picked direct into the market package.* Apples and pears, on the other hand, are usually picked into baskets or pails and then transferred to storage or "orchard" boxes before removal to the packing shed. If unlined wicker baskets or rough-sided boxes are used, the fruit may be damaged. A sharp blow, or even a skin puncture due to one fruit knocking against the stalk of another, may result in the setting up of rot which will seriously depreciate the value of the fruit and make it useless for storage. Suitable types of picking receptacles were shown. The crate pattern of orchard box is well adapted for hard fruit; it is of convenient size for handling and economical of storage space.

Ladders for picking orchard fruit should be strong, but light; heavy and cumbersome ladders, that are likely to cause injury to branches and spurs, should not be used; the three-leg step ladder is to be preferred for medium-size trees. The ladders illustrated in the exhibit were suggested as the most practical for fruit-picking.

Grading.—It is not generally realized that the market for ungraded fruit in this country is rapidly contracting. The high standards of grading adopted by overseas growers who market their fruit here, and the steady increase in the quantity of graded home-grown fruit coming on to the markets, must eventually force low-grade fruits out of the main channels of trade. Indeed, the best buyers do not purchase ungraded fruit.

Many home growers make some attempt at grading their fruit before sending it to market, but the methods adopted not only vary from one grower to another, but are frequently crude and are rarely precise. A multitude of grades, and of grading methods of varying degrees of efficiency, is a serious business weakness which hampers distribution and handicaps home-grown fruit in its competition with imported supplies. What is

* It is hoped to reproduce illustrations of this demonstration in the next issue of this JOURNAL.

needed is the adoption of *standard* grades for home-grown fruit. A complete set of standard grades has been put forward by the Ministry; these have been carefully drafted and are believed to be suited to British conditions. Where possible, samples of fruit graded to these standards were shown. Comparison of these samples with those of ungraded fruit demonstrated the obvious selling advantages and more attractive appearance of the graded product. It is by such methods of uniform grading that large shipments of imported fruit change hands by sample, and, in many instances, by mere reference to the label or brand on the package.

Several types of hand-grading machines are in use in this country—mainly on the smaller fruit holdings—and a number were shown or illustrated in the exhibit. As a rule, hand-grading machines grade for size only and do not have adequate provision for grading for colour and blemish. The power-driven mechanical grading machines of large capacity, such as that demonstrated, are intended for use when considerable and continuous supplies of fruit are available.

Large low-grade apples and pears find an outlet in canning factories, which also take well-grown samples of other fruits. To ensure the best results, all soft fruits for canning must be graded carefully for colour, size and ripeness. There is an increasing demand for cull apples for cider purposes. The importance of commercial and domestic canning and of other subsidiary outlets was demonstrated.

Packing.—Firmness and tightness of pack are essential. Fruit will support considerable pressure if this is evenly applied and distributed, but packs that become loose lead to serious damage through bruising. Fruit should, therefore, be so packed that contact is maintained throughout transit. The methods of packing apples and other fruits demonstrated or exhibited were simple and have been arrived at after considerable commercial trial. They are suggested as standard methods of packing home-grown fruit.

Packages.—Some 25 years ago, growers began to realize that a package, cheap enough to be used once only and sold with the contents, removed many of the difficulties associated with the use of returnable containers. The first breakaway from the old system was made by strawberry growers, whose need for speed and elasticity in distribution is very great. The adoption of non-returnables for other fruits followed somewhat slowly at first, but there are signs that the returnable-

basket system for all fruits is threatened with ultimate extinction for other than local trade. In an average season, the number of non-returnable packages used for home-grown fruit already approximates to 24 million. These are almost wholly used for strawberries, raspberries, currants, tomatoes and cucumbers. On the other hand, non-returnables are, as yet, only used to a comparatively small extent for apples, pears, plums and gooseberries. Imported fruits of these kinds arrive almost entirely in non-returnables and pass readily and freely through the markets, while home-grown supplies, in returnables, sometimes move with difficulty. Although the non-returnable system has made fair progress, growth has been haphazard and has resulted in an infinite variety of dimensions and capacities in all packages other than the apple box. The packages exhibited were those which the Ministry suggests should be standardized throughout the trade. Standardization of packages is as important as the standardization of grades, and both are essential for successful business, under present conditions, on the wholesale markets of this country.

Organization.—Modern developments in fruit distribution call, not only for standardization of grades, packs and packages, but also for large and regular supplies of the standardized goods. Individual growers can seldom, by themselves, supply the necessary volume, nor can they, as individuals, secure the most efficient distribution of their produce. To secure the best results and most economical working, the ungraded supplies from individual orchards and plantations should be concentrated at selected centres (packing stations) in the producing areas and there graded and packed by specialists and marketed, under their direction, in the form of a steady supply of graded produce. An organization of this kind need not be co-operative. It is difficult to demonstrate it in an exhibit and all that could be done was to suggest, by poster and diorama, the gap that the packing station should fill in the fruit growers' organization. It should be understood that no packing station can succeed unless assured of a steady stream of supplies, including all the growers' best fruit and not merely all his worst. Practically all imported fruit passes through packing stations.

Advertising.—All fruit is grist to the mill of the distributors whatever its source. It is their job to supply what is in demand. A demand for a particular product can be created and sustained by judicious advertising, and this has been accomplished by many of our overseas competitors who have succeeded in

popularizing a particular brand of fruit on the markets of this country. The home grower, on the other hand, is, at present, in a position only to advertise fruit in general, and any resulting increase in demand would, of course, be shared by his competitors. If the home grower wishes to advertise to advantage, he must establish brands of home-grown fruit and proceed to make them a household word. If packing stations in a particular fruit-growing area would agree to work to the same standards of grades, packs and packages, then an area brand or trade-mark becomes feasible. If, to carry the idea a stage further, packers in the various fruit-growing areas agreed to work to national standards, such as those suggested, then a *national* brand or trade mark becomes a possibility, and the home grower will then be in a position, by advertisement, to divert demand to the home-grown product. Suggested area and national marks were on view.

Refrigeration.—The cold storage of home-grown fruit is not undertaken to any great extent, although the practice is increasing. Numerous cold stores exist in consuming centres, but these are not generally used for fruit. In any event there is little cold storage accommodation where it is really wanted, that is, at the production point. Refrigeration of fruit can serve two purposes :—

(1) To hold fruit off the market at a time when supplies are heavier than the market demand and to prolong the marketing season. This is storage proper and, in the exhibit, attention is duly drawn to its importance.

(2) To reduce the temperature of fruit before its journey to market in order to delay the ripening processes so that it arrives on the market in a fresh condition. This is sometimes called "conditioning." If this is done as a preliminary to placing fruit in cold storage, it is called "precooling." A chilling plant suitable for this purpose was shown.

The technique of these two processes is different, but it is possible to combine both methods in one installation. It is of the greatest importance that fruit should be cooled within the shortest possible time after picking.

The Commercial Pig.*—A large proportion of the pigs marketed in this country fail in one or more respects to comply with the standard required by either the pork butcher or the bacon curer, the chief fault being excessive fatness. Further, owing to a lack of precise knowledge of the requirements of the different markets, many pigs are sold unclassified as to either weight or quality.

* It is hoped to reproduce illustrations of this demonstration in the next issue of this JOURNAL.

The object of the demonstration, therefore, was to show the *standard* of pig and carcass best suited to the various demand categories of the trade, and to illustrate the principal defects which make pigs unsuitable for any trade and consequently unremunerative to the producer. In this task, the Ministry was assisted by the National Federation of Meat Traders' Associations and the Western Curers' Association, and a committee representing these organizations selected the animals, carcasses and joints shown.

Live Pigs.—The live pigs exhibited were chosen, irrespective of breed, to illustrate the type, weight and conformation best suited to each of the following markets :—

Pen No.	Market	Grade	Representing a DEAD Weight of
1	Fresh Pork ..	Porkers	60–80 lb.
2		Porkets	80–100 lb.
3		Cutters	100–130 lb.
4	Wiltshire-Side Bacon Trade.	Sizeable Baconers	130–170 lb.
5	Midland and Northern Ham and Bacon Trades	Baconers	150 200 lb.

A pen of pigs (Pen No. 6) conforming to the weight requirements of the Wiltshire-side bacon trade, but unsuitable in other respects, was also shown.

The pigs in the first five pens, whether in the pork or bacon categories, had certain characteristics in common. Thus, there were no black pigs, neither did pigs of any one pure breed predominate. Heads were of medium size, indicating absence of excessive bone formation and of excessive weight in front ; necks and shoulders were light, these being the least valuable parts of the carcass ; backs were firm and level ; ribs were well sprung and bellies had a straight underline ; hams were broad, deep and full to the hocks ; flanks were thick and well let down. Attention was duly drawn in the exhibit to the effect of unsatisfactory conformation on value.

It is the general opinion of the pork and bacon trades that certain first crosses are the most suitable for their respective requirements ; these opinions were put forward in the form of statements signed by the trade organizations concerned and were displayed for information. It is significant that both butchers and curers are unanimous in the choice of the boar, the Large

White being insisted on, and both have almost identical preferences as regards sows. The Large White boar has played an important part in the principal countries which send Wiltshire-cut sides to Great Britain, namely, Denmark, the Irish Free State, the Netherlands and Canada, and also in those countries interested in the English pork market.

Carcasses, Sides, etc.—These were divided into three groups, representing the pork trade and the Wiltshire-side and Midland curing industries respectively, and were as follows :—

Pork Trade :—

(1) Typical carcass of a "porker" (60–80 lb. dead weight).
(2) Typical carcass of a "porket" (80–100 lb. dead weight).
(3) Typical carcass of a "cutter" (100–130 lb. dead weight).
(4) Unsuitable carcass showing results of indifferent feeding.
(5) Unsuitable carcass showing seedy cut.
(6) Carcass illustrating the method of packing for Smithfield Market, London.
(7) Sections of carcasses cut transversely behind the shoulder to show the advantage of the arched as compared with the flat back.
(8) Carcass showing depreciated value owing to excessive fatness.

Wiltshire-side Trade :—

(9) Typical sides of bacon of the following grades :
  (*a*) Lean Sizeable English.
  (*b*) Sizeable Danish.
  (*c*) Sizeable English.
  (*d*) Medium English.
(10) Unsuitable sides showing bad conformation and disproportionate fat and lean.
(11) Unsuitable sides, showing results of improper feeding.
(12) Unsuitable sides, showing seedy cut.

Midland Trade :—

(13) Typical best-grade English hams.
(14) Unsuitable hams due to improper feeding.
(15) Overfat and badly-shaped hams.
(16) Typical shoulder-bellies for the Midland trade.
(17) Unsuitable shoulder-bellies showing disadvantage of excessive fatness.
(18) Shoulder-bellies, showing effect of feeding stuffs of too high oil content.

Typical Carcasses, Sides, etc.—Specimens of these were shown for each group. In the pork group, the carcasses of porkers, porkets and cutters corresponded to the live pigs in pens 1, 2 and 3. The carcasses were within the weight requirements specified ; the meat was firm and of a good bright colour with a suitable proportion of lean to fat ; the skin was thin, smooth and mellow. In the Wiltshire-side bacon group, three selections of English bacon and, for comparison, sides of sizeable Danish bacon were exhibited. It cannot be too strongly emphasized that only pigs of the type shown in pen 4

are suitable for the production of the best grades of Wiltshire-side bacon demanded by the consumer in this country. Similarly, in the Midland curing industry, the best grade hams, which are required for both home and export trade, and shoulder-bellies are produced from pigs of the type seen in pen 5. These conform in carcass specification to the pigs required for the Wiltshire-side trade; the range of dead weight is, however, slightly wider, namely, 7 score 10 lb. to 10 score.

Unsuitable Carcasses, Sides, etc.—The principal defects in carcasses for pork or bacon arise from unsuitable breeding or feeding, or both.

Unsuitable Breeding.—Breeds vary in their ability to meet the requirements of butchers and curers. Certain breeds, it is held, have naturally thin streaks and bellies; others have consistently thick streaks—unfortunately, thick streaks are often associated with excessive back fat; others, again, have a thick rind, others a thin rind, and so on. Black pigs are considered to suffer from certain disadvantages, namely, the visibility of *seedy cut*, which reveals itself as a black, spotty discoloration of the milk ducts of some *female* pigs, the unattractive appearance, when dressed, of black heads and feet and the racial tendency of the flesh to be of coarse texture.

Unsuitable Feeding.—Correct feeding, which is reflected in the substance, colour and texture of the flesh and, to some extent, the quality of the bone, is not less important than judicious breeding. It has often been said that the only pig to pay its way is the good pig well fed, and that the best pig, badly fed, will turn out a bad pig. Improper feeding may lead to excessive fatness, irrespective of weight; this is a common defect of home-produced pigs. The demand is for small, well-finished, fine-boned carcasses, with a good proportion of lean and a low proportion of offal, early maturity being an important consideration. Then, again, the use of inferior feeding stuffs, or the misuse of suitable foods, causes otherwise excellent carcasses to turn out practically worthless or to be reduced seriously in value. Swill-fed pigs are obnoxious to the bacon curer; carcasses of pigs indifferently fed on wash are common on the fresh pork market. Maize, rice meal and certain oleaginous foods, when fed indiscriminately, produce dark, coarse flesh and soft, spongy fat. The use of fish meal of the wrong kind, or in excessive quantity, or too close to killing time, taints the flesh and makes it unsuitable for either pork or bacon.

Specimens of unsuitable carcasses, sides, etc., illustrating the various points referred to above were shown for each group.

History charts, supplied by Harper Adams Agricultural College, giving details of feeding, weight and cost, and charts, photographs and diagrams, supplied by the Animal Nutrition Institute at Cambridge, relating to Scandinavian methods of pig recording, were also shown.

Packing of Pork Carcasses.—The correct method of packing for Smithfield Market, London, was demonstrated. Carcasses forwarded to this market, by either road or rail, should be suspended during transit, wrapped in clean stockinette or muslin cloth, further enclosed in stout hessian and completely sewn up.

By-Products.—All efficient industries pay as much attention to the by-products as they do to the main output. A display of small goods or delicatessen, a selection of various by-products, and a variety of pharmaceutical preparations were shown in order to demonstrate the commercial uses to which all portions of the pig are put.

* * * * * *

HERBAGE SEED PRODUCTION IN NEW ZEALAND:

II—RED CLOVER AND LUCERNE

Professor R. G. STAPLEDON, M.A.,
Welsh Plant Breeding Station, Aberystwyth.

IN recent years, New Zealand has harvested considerable quantities of red clover. In 1924–25 the total crop amounted to 899 tons, which was in excess of all other herbage species, except rye-grass, while, since 1916, the crop has usually exceeded 450 tons. In 1925, the export amounted to 207 tons, rather less than one-third of this quantity going to Australia and the bulk of the remainder to the United Kingdom, though, doubtless, much of this latter was re-exported. Twenty years ago, New Zealand was importing more red clover than she exported —the exports now frequently exceed the imports.

About thirteen years ago, New Zealand was importing practically all her lucerne seed; this is rapidly altering, and, to-day, the majority of the seed used in the Dominion is home-grown, and there is a ready and increasing demand for locally-produced seed of high quality. At present, New Zealand lucerne is, to all intents and purposes, not used in this country, while New Zealand is not regarded as a regular source of supply

for red clover in large amount, although the seed in certain years may be imported in appreciable quantity to make good deficiencies from other sources.

The chief interest to the British farmer regarding the production of red clover and lucerne in New Zealand, is the cash-earning aspect of these crops. It is true that, speaking generally, the climatic conditions in the Canterbury and Marlborough districts of New Zealand are far more favourable to the harvesting of herbage seeds than are the conditions ruling over the greater area of England and Wales.

A seed crop from a herbage species is, however, a very important addition to the earning capacity of a ley, and the taking of such a crop is a practice that fits in admirably with the production of fat lambs, and with animal husbandry in general, conducted on grassland consisting predominantly of long duration leys.

RED CLOVER

Crop Production.—In both the Marlborough and Canterbury districts, autumn and spring sowing can be adopted with almost equal success, and, in both districts, the harvesting of a seed crop in the first harvest year is not a foregone conclusion, but will depend to a considerable extent on the weather conditions, and on the amount of keep available for the lambs. The whole procedure is, therefore, one of considerable flexibility, the more so since, in New Zealand, the red clover almost invariably persists in good quantity into the second harvest year; so that seed is frequently taken in the second harvest year instead of in the first year, while, sometimes, it is taken in both harvest years and occasionally even in a third harvest year. Amongst many growers, the view is held that the second year's crop gives seed of the highest quality. This may be due to the well-known fact that a too crowded stand of clover is not as satisfactory as a relatively thinner stand for seed production. The methods adopted, and which lead up to seed production, are very varied. The following cases of practices adopted in the Marlborough district afford interesting examples.

Example I.—Eight pounds of red clover with 40 lb. of Italian rye-grass, and 1 bushel of Algerian oats, sown in March (autumn). This mixture will become rapidly established and, by August, may be depended upon to give an abundance of green grazing for lambs. The Italian rye-grass and the oats will be grazed very hard during the late winter and early spring of the sowing year, and the red clover will not be seriously harmed. The field would be shut up in time to give a seed

crop (of red clover) in the following March. This productiveness, within a twelvemonth of sowing, affords a striking commentary on the immense benefits, to the farmer, of a climate which allows of autumn sowing of herbage seeds followed by a winter and early spring which permits of continued and abundant growth from autumn sown oats and Italian rye-grass.

Example II.—Sow a full seeding of oats in March and 10 lb. of red clover on the brairded oats. By the following December, the oats will be cut for oat-hay (including some red clover) and will be chaffed for sale off the farm.* The field will then be "put up" for a seed crop of red clover which will be taken in April.

In many cases, the leys will remain standing for three to four years, when they will be ploughed and re-sown with oats and red clover. This, in some instances, constitutes the rotation practised over the whole farm, with, perhaps, a crop of white clover taken off a ley, sometimes, in the fourth year, before it is ploughed. Usually the paddocks will be given a periodic change in lucerne instead of red clover. It is somewhat remarkable that, despite this very continuous growing of red clover in the district around Blenheim, clover sickness in any form does not appear to be a factor that has to be seriously reckoned with.

In the Canterbury, as in the Marlborough, district the rotations are very flexible, but in the former a cereal as such (for grain) more usually enters into the rotation. The type of rotation is generally more or less as follows: rape; wheat; oats (seeds sown either with the oats or on the stubble in the autumn); temporary grass for three (and sometimes up to six) years. Some of the leys, as occasion permits, will be devoted to red clover seed production, and it is not infrequent for a particular ley to give a crop of clover hay and a seed crop in each of the three harvest years. The writer was informed of cases where a seed crop had been taken in a sixth harvest year.

Harvesting Practices.—The best growers look for yields of from 300 lb. to as much as, or exceeding, 500 lb. per acre; the general average yield, however, frequently falls below 200 lb. per acre.

The seed crop is always stacked and never thrashed from the stook. The hulling is almost invariably undertaken by

* The city horse is still in decided evidence in New Zealand, while horses are largely used in connexion with timber milling, so that favoured districts still do a considerable trade in connexion with horse feed.

travelling mills, as is the case with lucerne and white clover, the charge being, usually, 25s. to 27s. 6d. per hour. It is interesting to remark, in passing, that whereas the hullers are invariably of American make, the steam engines are as constantly British. In so far as agricultural implements in general are concerned, it is indeed only in respect of the stationary oil engines, and the steam engines, that the British manufacturers may be said to have completely held their own.

The bumble-bee was introduced into New Zealand in 1885, and these fertilizing agents now appear to be general in the clover-growing districts. Complete or almost complete failure of the seed crop is not usual. It may be observed, however, that exceptionally poor yields have been recorded in the Blenheim district following seasons of severe winter-flooding, which would, doubtless, be responsible for the large-scale destruction of the bees' nests.

Characteristics and Agricultural Usefulness.—New Zealand red clover, or "cowgrass" as it is usually called in the Dominion, appears always to be of the broad red type, and this is confirmed by Capt. Williams's investigations at the Welsh Plant Breeding Station. It is interesting to find, therefore, that, in New Zealand, this strain invariably holds the ground well for two years and, frequently, for much longer periods. Trials at Aberystwyth have also shown that New Zealand red clover tends to last into a second harvest year rather better than the generality of strains of broad (or early) red clover, though not as well as the late-flowering reds. This clover is more uniform in character than most of the European strains. It is more closely allied in botanical characters and manner of growth to the North American (*e.g.*, American Medium and Canadian) strains than to the European, having a more spreading habit of growth than the latter and being more hairy—it is not, however, as hairy as the American clovers. In common with American Medium and Canadian, New Zealand clover makes very little growth in the winter in this country, but it is nevertheless one of the earliest strains to flower, being but four to five days later than American Medium, which is the earliest to flower. At Aberdeen, it has given excellent results in the first harvest year; at Garforth, it gave excellent stubble grazing, and was decidedly productive, in the first harvest year. At Aberystwyth, it gave decidedly less stubble grazing than English broad red, or than Chilian red. In the first harvest year at Aberystwyth, it has given somewhat variable results. In 1924, it outyielded most of the other broad reds,

while, in 1921, and again in 1923, it was inferior to British and to several other strains of broad red, but, on the average of all the trials, has proved distinctly superior to French and Brittany red.

In view, particularly, of the fact that New Zealand red clover has an undoubted ability to run into a second harvest year, and that, in the main, it has given good results in the first harvest year, it would seem desirable that more extended trials should be undertaken with this strain. This would seem the more advisable since the seed coming to this country is usually plump, heavy and of good colour: the seed is invariably larger than that of the closely-allied American Medium and Canadian nationalities, while the New Zealand samples also contain considerably less yellow seed.

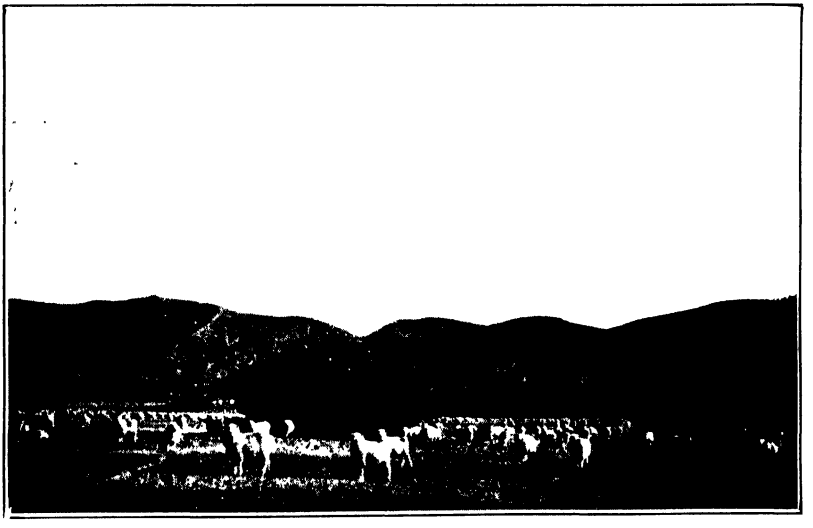
Marketing Practices.—Blending is largely adopted, especially for the export trade to Europe, the chief aim being to ship bulks which conform to the purple coloration which, probably, does denote a sample harvested and matured under highly satisfactory conditions. Blending on these lines, however, entirely overlooks the question of strain and the possible, nay, probable, effect on longevity of harvesting from leys subsequent to this first harvest year. A long-duration, broad red clover would be of extreme value to British no less than to New Zealand graziers; it is, therefore, much to be desired that tests with so-called New Zealand cowgrass should be conducted in relation to the year of harvest of the seed, and not on blended lots, since blending entirely masks the all-important, albeit subtle, differences as between strain and strain.

LUCERNE

Crop Production.—Lucerne is very extensively grown in the Marlborough district, and it was estimated, in 1916, that there were over 4,000 acres under the crop in that district alone. The leys in this district are grown on an almost ideal lucerne soil—a very deep, rich, calcareous alluvial loam. Many of these leys have been down for 10 to 20 years, and it is a common occurrence for seed to be taken from leys 10 to 15 years old.

Frequently, however, seed is taken from a ley in its second year, and then yearly for a number of years: but speaking generally, a very large proportion of the Marlborough district seed is taken from old leys. Seed production from old leys, however, presents certain difficulties. The old leys tend to become very grassy. *Poa annua*, *Poa pratensis* and barley

Flock of 800 ewes on lucerne, Marlborough, N.Z.



Lucerne stock, Marlborough, N.Z.

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grass in particular are very bad weeds. The older leys have in recent years, however, been enormously improved by generous applications of superphosphate, and by resort to heavy harrowing in the autumn with strongly tined implements. Many of the leys have been completely regenerated by these means and are yielding heavy crops of seed where seed has never previously been harvested.

It is the usual practice to graze the leys all through the winter with sheep, and such is the suitability of the soil, and the climate, for lucerne that the plant withstands this rigorous treatment in a remarkable manner. The lucerne hay is, however, stacked in the paddocks and fed to the sheep during the winter, so that this supplementary feed serves to some extent to reduce ultra-close grazing of the lucerne crowns. A number of the Marlborough sheep farms consist partly of lucerne land and partly of improved or semi-improved native tussock grasslands. The high stock-carrying capacity of such farms and, incidentally, the immense value of lucerne, when it grows to perfection, is indicated by the following example :—

Acreage	.. ..	550 acres.
In lucerne	.. ..	220 acres (leys 5 to 15 years old).

On this farm, an average of 1,500 ewes are regularly wintered.

Harvesting Practices.—The crop is always cut when fully ripe, *i.e.*, when some of the pods are turning black, and it is customary to risk a certain amount of shedding. The crop is cut with a side-delivery reaper and handled as little as possible ; it is sometimes carried within eight days of reaping and is usually stacked for about three months before hulling. The dry haulms are frequently fed out on the paddocks to store cattle. The yield of seed may reach 750 to 1,000 lb. per acre. Various practices are adopted prior to the seed harvest, but a hay crop always precedes the seed crop. The necessity of taking a hay crop as preparation for a seed crop entails the production of rather more hay than can normally be consumed, but this at least safeguards an abundance of supplementary winter feed. The following procedure is one commonly adopted by those who are fatting lambs :—

August—November. Ewes grazing with their lambs until fat lambs sold off their mothers ; close the field until the *middle of December*, when a crop of hay is taken. Again close the field and take a crop of ripe seed in *April*.

The seed is usually sold on sample rubbed out from the stack, and on the basis of guarantee of freedom from dodder

and other noxious weeds. In recent years, the grower has received up to 12½d. per lb. for the seed, and it is no uncommon thing for one man to harvest as much as 100 acres of seed, as much as 200 acres having been put up to seed on a single farm; consequently very large cash payments have been credited to lucerne on Marlborough farms since the war.

Leys are, to some extent, now being sown primarily for seed production, and drilling at a somewhat reduced seed rate is advocated for this purpose.

Characteristics and Agricultural Usefulness.—With lucerne, as with red and white clovers, blending is rather the rule than the exception. It follows that no exhaustive tests have been conducted, so far as the present writer is aware, with seed harvested from young as compared with old leys. Marlborough lucerne has, furthermore, not been extensively tested in this country; it is desirable therefore that proper tests should be instituted, but, as with the clovers, it is idle to conduct these with blended samples. The full potentiality of this lucerne should rather be tried out by using specially collected lots harvested from leys of known age. New Zealand lucerne, since, in the main, it is largely grown in districts where red clover is also abundantly employed, is prone to contain, as an impurity, greater or less amounts of this clover.

Thanks are due to Captain Williams, M.Sc., for providing data as to the behaviour of New Zealand red clover at Aberystwyth.

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MILKING COMPETITIONS HELD IN CONJUNCTION WITH CLEAN MILK COMPETITIONS

J. H. MATTINSON, B.Sc. (Agric.),
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FEW operations on the farm require more skill and concentration than milking, which is one of the chief factors of success in dairy farming.

Really first-class milkers are not very numerous. This, no doubt, is because a man is seldom taught to milk; he is allowed to acquire the knowledge himself. Beginning with cows which are easy to milk, he gradually improves his speed on the methods and style which come to him naturally. It is not surprising therefore that many milkers cultivate habits which are undesirable and which are not conducive to efficiency.

In recent years, clean milk competitions have emphasized the importance of the human element in the production of milk of a high standard of cleanliness, and have shown how great a responsibility lies with the milkers for the delivery to the milk room of milk of low bacterial count.

In the Surrey Clean Milk Competitions, it has been the practice to take sediment tests from the unstrained milk, and these tests are taken as each man finishes milking a cow. A pint of milk is poured from the pail into the tester and is forced through a small cotton-wool disc or pad ; any dirt or dust gaining access to the milk during milking is thus exposed on the pad. It was found that this test indicated the efficiency or otherwise of the cleaning of the cows ; it was, further, found that the cleanliness of the disc reflected to a large extent the skill of the milker. Where the washing of the cows in a herd had been the same throughout, some men would return clean discs, others dirty ones. Those who milked quickly, quietly, with full hand, employing a squeezing action on the teats with no arm movement, obtained cleaner milk than those who milked with a pulling action.

This test, carried out in the cowshed, has been proved to have great educational value by bringing home to the milkers the need for efficiency in cleaning the cows and the importance of good milking. The accompanying illustration shows the discs taken on a farm where six milkers were employed, and where all cows had been cleaned alike. They indicate the difference in milkers and the extent to which a man could improve at a second attempt.

When, in 1925, the Ministry of Agriculture drew attention to the value of competitions for the encouragement of skill in farm operations, it was felt that the clean milk competition offered excellent facilities for conducting, simultaneously, a milking competition for the workers.

At the time inspecting judges visit the farms for the purpose of awarding points for methods and equipment, and for taking surprise samples, ample opportunity is afforded them of seeing the milkers at work under ideal conditions for forming an opinion on their skill. It was hoped such a competition for milkers would give added interest to the workers and have distinct educational value by stimulating keenness in good methods.

The Surrey Agricultural Committee therefore decided to conduct a Milkers' Competition concurrently with their 1926 Clean Milk Competition. Miss M. M. Macleod, N.D.D., C.D.D.,

the then Instructress in Dairying and Poultry Keeping to the county, and the writer were the inspecting judges in the Clean Milk Competition; with the valuable assistance of Mr. J. Mackintosh, of Reading, they devised the score card appended below and, by it, judged the milkers.

SCORE CARD	Points
(*a*) Preparation of cow for milking	10
(*b*) Personal cleanliness of milker, suitability of dress and equipment	15
(*c*) Style of approaching cow and management during milking	10
(*d*) Management of fore milk	7
(*e*) Skill in milking, including grip, motion and style	20
(*f*) Thorough stripping and method of carrying out same ..	16
(*g*) Time taken in relation to quantity of milk produced ..	12
(*h*) Cleanliness of milk	10
TOTAL	100

MILKING TEST

Name of cow	Name of cow	Name of cow . . . .
Time beginning	Time beginning .	Time beginning . . . . .
Time ending	Time ending	Time ending . . . . .
Quantity of milk . .	Quantity of milk . . .	Quantity of milk . . . . .

REMARKS.

This score card does not differ to any great extent from that suggested by the Ministry of Agriculture. Two classes were provided, one for milkers under 18 years of age, the other for those of 18 and over. It was decided that money prizes should be awarded to the first three in each class, and that certificates of merit should be presented to those attaining a sufficiently high standard of merit. A copy of the rules of the competition, giving particulars of the scale of points on which the judging would be based, was circularized to the farms along with the particulars of the Clean Milk Competition.

The following discussion of each item of the score card will indicate how the judging was carried out.

Preparation of the Cow for Milking.—Before milking is commenced, the cows should be thoroughly cleaned. As time is valuable, it is very essential that the milker be able to clean the cow effectively and rapidly. Only a good system, which has become a matter of habit, will enable this to be done. If the system is not good, either the man takes too much time or he does not clean the cow. Observations at the farm quickly show whether the men are doing as they are accustomed to do. If the cows are used to the treatment, they take no notice of it. If extra trouble is being taken for the benefit of the judges, the cows show impatience.

A man who has established a routine which is good does the work speedily, changing the water as it becomes dirty, and taking care to finish off the udders with clean water. It is a simple matter to time the milkers over this operation, the effectiveness of which is further checked by the sediment test.

Personal Cleanliness of the Milker, Suitability of Dress and Equipment.—It is much easier to judge this on the farm than it would be at a show, where the milker would arrive specially "spruced up" for the occasion.

In the cleaning of the cows, the milking and the handling of the milk in the shed, there are so many opportunities for a milker to show whether he is scrupulously clean or not. The milker, whose aim it is not only to milk speedily but in a cleanly manner, is particular in details. He is clean in himself, he takes care to keep his overalls as clean as possible, he keeps his nails short, and washes his hands before milking each cow. His stool is clean and, after each cow is milked, is set down carefully and not in such a way that it may possibly fall over. He uses the covered pails as they are intended to be used, and when not in use lets them stand so that the open part is not exposed to possible contamination.

The help given, to encourage cleanliness, by the provision of suitable equipment and adequate facilities for washing, must, of course, be assessed for each particular farm.

Style of Approaching the Cow and Management during Milking.—Cows, and more especially the heavier milkers, are very sensitive animals; any disturbance will be reflected in the yield. It is therefore essential that the cows be treated gently at all times and particularly at the time of milking. If the cow is not disturbed, the milk secretion will start more readily and milking will be more expeditious. Good milkers realize this; they are quiet in manner and voice, approach the cow with a word so that she is not startled at their sudden appearance, coax her into a favourable position, and then sit down on the stool with the pail in position without undue disturbance or noise. There is no necessity to stroke or pat the cows before sitting down and after the hands have been carefully washed. During milking, the good milker concentrates on the work of the moment and does not shout at the cows nor engage in loud conversation with other milkers.

The behaviour of the cows in the shed shows whether the treatment is generally good. Watch the cows come into

the shed, whether they walk in quietly or in a hasty, nervous manner. The presence of kickers is generally an indication of rough treatment at some time or other in their lives.

Management of the Fore Milk.—The importance of discarding the first strippings of milk from each teat is fully realized by all who have been competitors in clean milk competitions. Full marks were awarded when the fore milk was collected in a separate pail, one not likely to be confused with the other milk pails. This is the best method, because it becomes a definite operation and therefore less likely to be forgotten; moreover, when milk is squirted on to the floor it presents an excellent breeding ground for bacteria. Some milkers, by turning the teats, squirted the fore milk into the gutter, but most milked it straight on the floor, while a few did not discard it at all. Where it has not become a definite practice to discard the fore milk, the milkers frequently forget to do it unless a separate pail is provided for this purpose.

Skill in Milking, including Grip, Motion and Style.—Milking should be done whenever possible by a full-hand grip, the teat lying in the palm of the hand and the ends of the fingers reaching about three-quarters of the way round the teats. Finger-and-thumb milking is not to be encouraged. The milk should be expelled by a squeezing motion by horizontal pressure and not by a downward pulling motion. The arms of a good milker will remain motionless; all the work will be done by the hands and wrists. Where there is much arm movement there will be more sediment in the milk.

The milking should be done speedily (speed affects both quantity and quality) without change of action. Some milkers will milk a short time full handed, then with finger and thumb, and will occasionally devote both hands to one teat.

A good milker is particular about his milking stool and will be careful that the legs of the stool are of the right length. He will not milk with any stool. In some cases the legs of the stool were too long to allow of the milker sitting in a comfortable position.

Wet-handed milking should be discouraged. It was intimated in the rules that wet-handed milking would not receive encouragement from the judges, and this no doubt had considerable effect in preventing wet-handed milkers from entering. Very few really wet-handed milkers were therefore encountered in the competition, but some were rather careless

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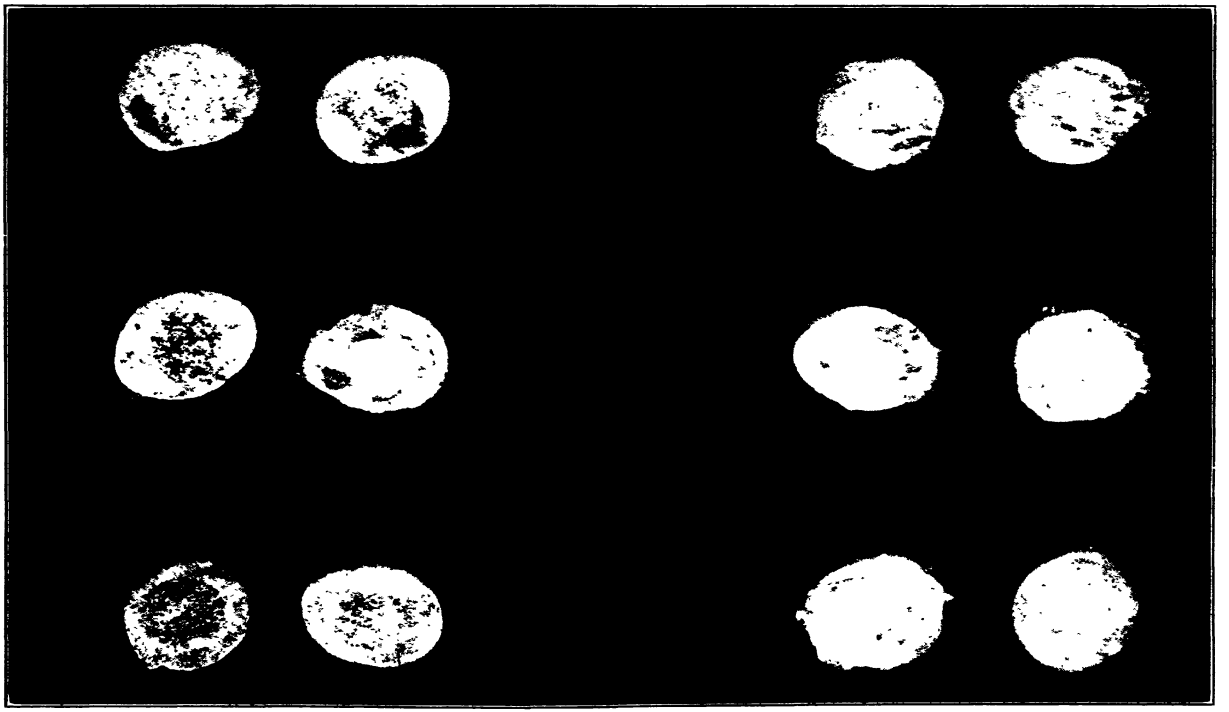

First Attempt. Second Attempt.

Discs from sediment tests on unstrained milk, taken on a farm where six milkers were employed, and all cows had been cleaned alike. Showing the greater cleanliness in the second set of discs, due to improved method.

in the way in which they allowed milk to get on to their hands by indifferent methods of milking. It is advisable to ask a milker of this type to show the palms of his hands when he is actually milking a cow.

Thorough Stripping and Method of Carrying it Out.—The last strippings from the cow are richest in fat; thus, if a cow is not milked out, the quality of the milk will suffer; moreover, if the cow is not properly stripped she will give less and less milk and speedily dry off. In a competition this operation must be closely observed, and, when the milker has finished, the judge should try drawing the teats and ascertain if the work has been well done.

While the full-handed grip is to be encouraged for the milking, the stripping must be done by drawing the finger and thumb down the teats until all the milk has been obtained. In some cases the milkers used one hand on the udder, lightly squeezing the quarter which was being stripped, while the finger and thumb of the other hand were being drawn down the teat. This is a very effective method and indicates the milker's appreciation of the importance of obtaining all the milk from the udder at each milking.

Time Taken in Relation to the Quantity of Milk Produced.—Each man was timed over the milking of at least three cows. The yield of milk in each case was weighed, and at practically every farm visited this yield could be compared with previous yields as given on the record sheets.

It was found that the quantity of milk obtained by naturally quick milkers compared favourably with previous weighings, while the quantity obtained by one who attempted to milk more quickly than usual was low for that particular cow.

Quick milking if done well and accompanied by efficient stripping is a very important factor in controlling the yield of milk and the percentage of butter-fat, and is to be encouraged.

Cleanliness of the Milk.—The points under this head were awarded on the result of the sediment test. One pint of milk is forced through a cotton-wool pad, leaving the sediment behind. After the milk has been forced through, some clean water is passed through the tester to carry on to the pad any hairs or sediment which may adhere to the sides of the tester.

Conclusion.—The competition proved very attractive to workers, and justified itself in the great keenness on the part

of the milkers to know their faults and to eradicate them where possible. 45 entries were received from workers on the 37 farms entered in the clean milk competition. Of these seven were in the class for juniors.

In addition to the three prizes awarded in each class, 12 certificates of merit were awarded and presented at the annual luncheon of the Surrey Milk Recording Society with the prizes and diplomas of the clean milk competition.

The winner of the county competition competed later in the milkers' contest at the Dairy Show in London and was successful in obtaining fourth place.

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PIG KEEPING AND FRUIT CULTURE AT WESTWICK FRUIT FARMS

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Horticultural Organiser, Norfolk County Council.

ACCORDING to agricultural history, there has always been a shortage of farmyard manure. Good lands grow the greatest amount of straw, but very few farms can produce sufficient for the actual demand of the cultivated land. Inorganic manures can only supplement the yard manures and, so far, no system of green manuring, plus inorganic fertilizers, has maintained any land in the highest condition of fertility for intensive cropping over a lengthy period. With the increase of fruit culture, the shortage of manure is accentuated, as the fruit lands do not produce straw or material for making litter. In these districts, the supply is automatically decreased while the need is considerably increased. The supply of manure from towns also shows a progressive reduction in quantity. This was the problem that confronted Mr. G. Davison, the manager of Col. B. J. Petre's fruit farms. It is a problem that is present to practically every fruit farmer and market gardener. It has been found that pig manure will enable the soil to gather fertility with greater rapidity and lasting effect than that from any other kind of stock. In several instances, pigs have made it possible to bring sandy, derelict land into a profitably fertile condition. Col. Petre and Mr. Davison, therefore, decided to keep pigs with the sole object of making manure for the 180 acres of fruit grown on the estate; the large acreage of black currants demands an abundant supply.

The Westwick System.—Although the production of pigs was not the primary object in view, Mr. Davison evolved a sound scheme to produce the best bacon pigs. His scheme is so arranged that the pigs are improving the fruit plantations all through their lives until they are entrained for the bacon factory. The fact that all the animals return the highest price at the factory, at a low cost of production, indicates the value of the methods employed. The success with black currant culture and other hardy fruits on these farms is largely due to the manure made available on poor, light, sandy soil. The breeds of pigs kept for producing the necessary vigorous youngsters are large black sows and large white boars. The parents lead natural lives on the pastures and are farrowed in movable wooden houses, specially devised by Mr. Davison, the sides and roof being held rigidly together by a few pegs. These sheds accommodate from 20 to 30 stores, and can be taken down and loaded on a cart in ten minutes for transferring to a new site whenever necessary.

The fruit plantations have lapsed into natural herbage since the war period, owing to increased cost of labour and to evolution in the methods in fruit production. Formerly the soil of the plantations was kept scrupulously free from weeds at a high cost for labour. The pigs now do the necessary soil work and have increased the weight and quality of the crops through their fertilizing activities. Part of the plantations is wired to three-quarter acre pens, in each of which about 25 young pigs, eight weeks old from the sows, are drafted, being dry fed and given an ample supply of clean water. They also receive a daily ration of either marrow-stemmed kale, swedes or mangolds throughout the year. The animals are induced to work the soil over the whole pen by the moving of the dry-feed boxes, even distribution of the root feed, and by moving the shed. They sometimes work the soil too deeply in places, presumably rooting for some mineral, although they are supplied with a mineral ration. Such spots are fenced with wooden hurdles if the rooting is likely to cause injury to the trees. Open sows in season will sometimes gnaw the bark of the trees, and have to be taken out of the pen for a time. The pigs also rub themselves against the trunks of the trees, but no injury has been noticed from this cause.

When the soil is all turned in the pens and the growth of grass checked for the time, the pigs are re-graded and transferred to another pen. The ground is then harrowed

level and left till the herbage grows for another occupation. The re-graded pigs are moved in smaller groups, usually of six, to pens which have been rested. When six or eight months old, they are ready for the next step in the order of production. The breeding, feeding and the life natural to pigs, have produced long, vigorous, short-legged animals, and their frames are correct for taking on meat rapidly just where the prime cuts lie.

Intermediate Pens. —The procedure at first was to transfer the pigs from the plantations direct to the fattening house, but the change was found to be too sudden and it also entailed alteration in the percentages of food mixing for pigs of varying age. Mr. Davison solved this difficulty by building covered yards in sheltered places, and, incidentally, the output of manure was considerably increased thereby. These yards are 48 feet square, accommodating 50 pigs each, and sunk 15 inches below the soil level and concreted with a rough face. Cross rails are nailed to posts that support the corrugated iron roof, and a fence of boards four feet high is nailed to the rails. Feeding troughs, faced with granite chips, are built into the sides of these shallow pits. The first yard constructed had a drainage system, but this was found to be unnecessary as the litter soaked up all the moisture. For litter almost anything available is utilized—straw, the brushings from the banks round the farm, leaves, and marsh litter. Although trouble from weed seeds was anticipated with this miscellaneous litter, no difficulty has been experienced. The yield from one yard was 100 loads of manure in three months. In these intermediate yards, the pigs are gradually brought on to a richer diet of barley, middlings, and maize with a constant supply of green food or roots; and after six weeks of this feeding they are ready to be graded into the fattening house. In the plantations they are actively searching for food all day, and grunting with satisfaction. In the yards a change of habit is noticeable: the richer food induces laziness and more time is spent lying down; and, after being settled in the fattening house, their activity is almost negligible, for they feed and sleep practically all their time.

The Fattening House.—The final stage of feeding is carried out in a specially constructed house of more than usual dimensions. It is known locally as the "pigs' palace," and is designed to accommodate 300 pigs. The length is 200 ft., width 34 ft., height 20 ft. The roof is a span with a glass lantern

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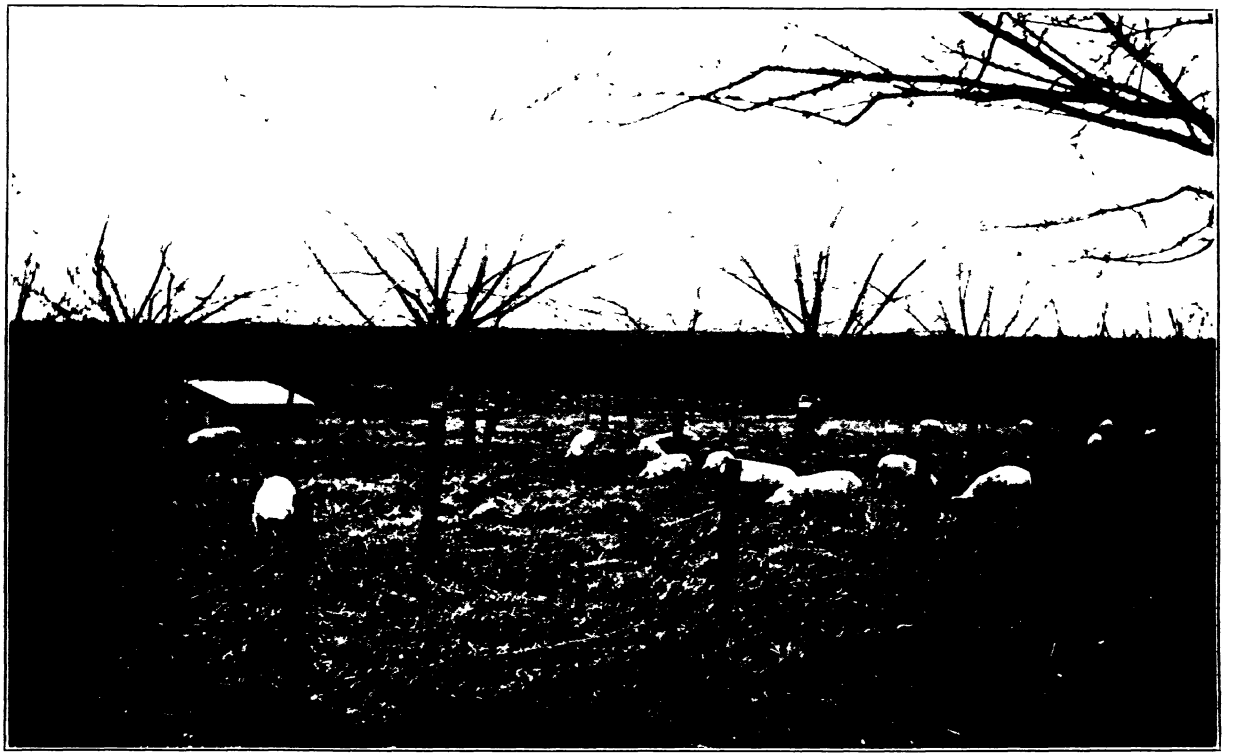
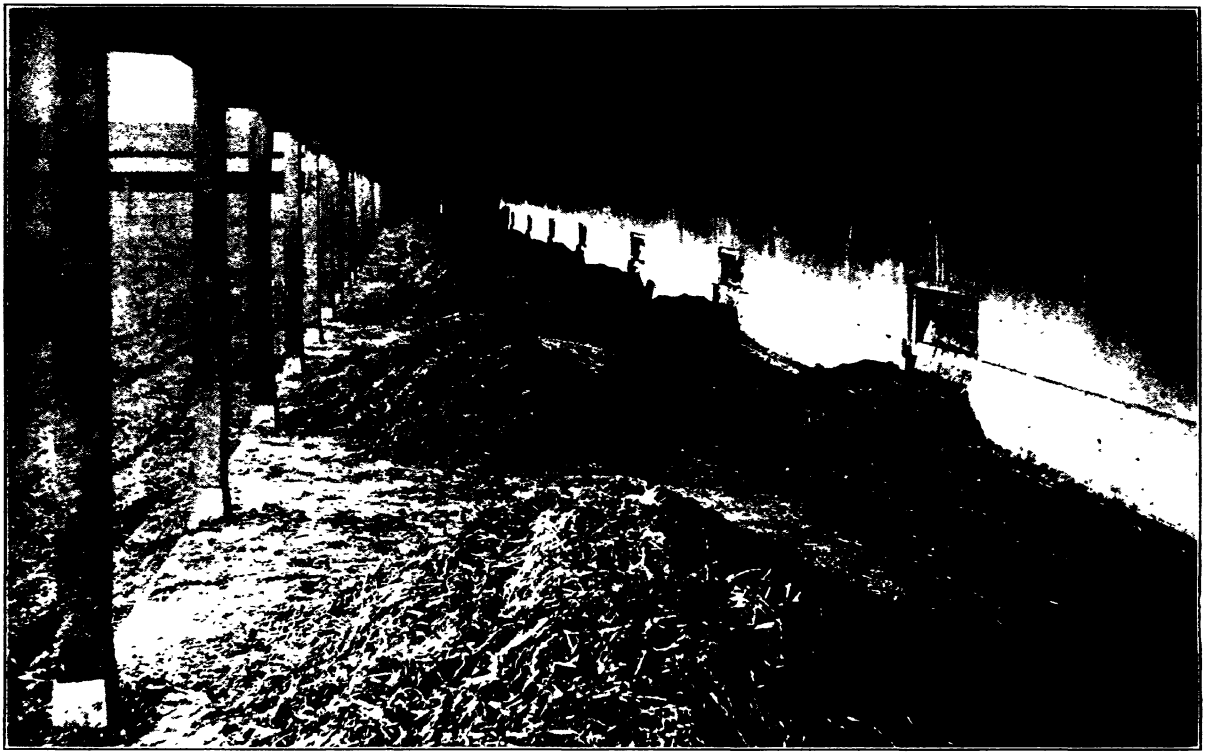
Sow, with eleven young pigs. Reared in the open.



Stores working the fruit plantations. Showing the Davison movable house.

The "Pig Palace," with accommodation for 300 fat pigs.



One side of the "Pig Palace," showing concrete surface, and swivel doors to each pen, through which the manure is thrown daily.

top, and windows are provided on each side, giving ample light. Ventilation is provided on each side of the roof and walls, and can be regulated from one position by turning a handled crank. The ventilating system adopted is the one common to span-roof glass-houses, and the "palace" is aired with as much care as choice greenhouse crops. On entering the house, one is struck with the scrupulously clean and neat appearance of everything. It is quiet, and the objectionable smell commonly associated with pig-keeping on any scale is absent. Pigs will keep themselves clean and wholesome if they have a chance. The floor is cemented all over. The pens are 20 ft. by 14 ft. and placed on each side of the house, the flooring of each pen having a fall of 6 in. to a gutter 3 ft. wide. This gutter has a 6 in. fall to a wide concreted surface that falls 24 in. and conducts all the liquid from every part of the "palace" to a large reinforced concrete tank constructed at the lowest end. The pigs do not soil any part of the fattening pens but the inside gutters. The manure is thrown from the gutters through a swivel door to the outer concrete surface at each side of the house, and eventually carted by motor lorry to the black currant plantations. The construction of the pens enables the pigs to co-operate in keeping the house clean, as all the manure is in the gutters and is easily thrown through the swivel doors each day. The outer concrete surface is covered and the manure is not leached by rain. The liquid from the tank is pumped by engine power to the fruit plantations and distributed by horse-drawn barrels on wheels up and down the rows of bushes that require stimulating. At every turn, Mr. Davison's ingenuity is shown in inventing articles and appliances to save labour and in utilizing the whole of the manurial output to the greatest advantage for the production of fruit.

Feeding and Finishing for Bacon.—When the pigs are drafted from the yards into the fattening pens, they are ready for richer diet. The main food is now 70 per cent. barley meal and 30 per cent. made up of middlings, bran and maize meal. All the grain is ground in the mixing house and soaked in water twelve hours, previous to being fed. A small proportion of boiled potatoes, and fish meal is included in the 30 per cent. portion of the food if these feeding stuffs are low in price. In the order of feeding, as with the whole organization, the system works the man. The first feed each day is given at 6 a.m. At 12.30 p.m. a green ration of roots or marrow-

stemmed kale is given. At 4 p.m. the final feed of meal is provided. Every trough is licked out clean and not a particle of the meal or green food is left over. The food is ladled from the mixing tanks into metal skeps on a small trolley. The trolley runs on rails the length of the house. Another trolley brings in the green food and straw from the opposite end of the house.

When the pigs are ready for the factory, the side of the pen is lifted across the middle path, the pigs walk to the weighbridge and from there into the rail trucks. The fat pigs are starved 24 hours before weighing and average 78 per cent. dead weight to live weight. The purchaser is responsible for the animals when they are delivered to the railway. Customers for these pigs have always praised the quality of the meat and frequently state it is the best that they receive. There is no wasted time in producing the finished animal, although it takes, on the average, twelve months to produce the finished article at an average weight of 22 stone per pig. At this weight, the system gives tender, lean, fine-flavoured meat without an undue proportion of fat. If a younger pig were brought to this weight, by intensive feeding, an undue proportion of fat to lean meat is naturally produced on a low-grade carcass. No trouble has arisen through seedy cut in the pigs of this cross, and although the average weight is heavy for bacon the pigs realize grade A 1 price. Mr. Davison's method allows a man and a boy, comfortably, to feed and keep clean 400 fattening pigs. The whole of the sheds and the buildings were built to his plans by labour on the estate. Col. Petre stated that the venture is a profitable undertaking and most of the capital expenditure has, also, been recovered. Westwick produces about 1,200 fat pigs per annum, a fair contribution for one farm to the national demand for home-fed and cured bacon.

Effect of Pig Keeping on Fruit Production.—The above is an outline of the main features of a system of pig-keeping, in conjunction with fruit culture, which I have not seen approached at any other centre. There is no doubt as to the beneficial effects of the pigs on the health of the trees and bushes throughout the plantations. The store pigs are utilized for improving the older plantations of apples and pears. In a few cases, parts of plantations are not included in the pens owing to the difficulty in wiring off these portions. To a certain extent these parts of the plantations act as a control to the trees inside the pens. The trees outside the pens in

every case produce smaller leaves, paler in colour, very indifferent crops of fruit and have an obviously starved appearance. Economy in running pigs in plantations is also shown to a marked degree. The whole cost of producing fruit amounts to pruning, spraying, gathering and marketing the crops. Soil cultivation and manuring are practically all effected through the pigs. The manure from the yards is utilized for the plantations of bushes and enables the farm to produce extraordinarily heavy crops of black currants, the quality of which is apparent to the numerous visitors who visit the farms each year. No part of the scheme is carried out in a hard-and-fast manner. Slight variations are continually being made, either for the benefit of the pigs or the fruit plantations. In this way continual improvements are being made, and new, ingenious, labour-saving devices are observable almost every time a visit is made to these farms.

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THE COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-fourth meeting of the Council was held on May 27, 1927, at the Middlesex Guildhall, Westminster. The chair was taken by Lord Clinton in the absence of Mr. W. R. Smith, who was, at the meeting, elected chairman for the year 1927.

Sir Francis Floud, K.C.B.—The CHAIRMAN said that everyone on the Council would feel great regret at the pending retirement of Sir Francis Floud from the Permanent Secretaryship of the Ministry of Agriculture to take up his new position as Chairman of the Board of Customs and Excise. Sir Francis had always shown the greatest interest in and sympathy with the agricultural industry, and the industry had always found him to be a firm friend, very willing to assist with information and advice. He proposed that the Council should congratulate him on the promotion which had come to him. Lord STRACHIE seconded the motion, which was carried with acclamation.

Statement by the Minister.—The Rt. Hon. WALTER GUINNESS addressed the Council. He said that the trend of agricultural prices had remained very unfavourable to the producer. Since the last meeting of the Council, the Report on *The Agricultural Output of England and Wales* had been issued. The figures in it merited careful attention, and he was sorry to see that he had caused indignation in certain quarters for having mentioned this census and for having drawn attention to the results

there recorded. Much as he sympathised with farmers in their present difficulties, he would be most unhelpful if he never dealt with any other subject, and did not mention other important aspects of the agricultural situation. The farmer nowadays needed defence from proposals which would put him in an even worse position, and there were plenty of traducers who were ready to argue that the British farmer was inefficient, basing their case on unfavourable comparisons with the Continent and an alleged falling off in the production of food in this country. There was no more effective answer to that line of attack than the figures summarised in the Report, which stated that the aggregate value of agricultural produce, £225,000,000 in 1925, was 77 per cent. above £127,000,000 estimated in 1908; the average increase in price over the same period was also 77 per cent. In the aggregate, the increases and decreases in output from the various branches of the industry had just about balanced one another. An even more recent publication, *The Agricultural Statistics, Part I, for* 1926, showed that the tendencies recorded in the Report still continued. There was a notable increase last year in the wheat acreage. The acreage under sugar beet had increased by no less than 130 per cent. As regards live stock, the number of cattle was the largest ever recorded. Sheep also showed an increase, and the number last year was only about 400,000 below 1914. So that transformations in our form of agricultural output were still going on. These very changes showed the very difficult time through which the farmer was passing. They were clear evidence of the dislocation which had taken place owing to the fluctuation in prices, and the farmer could not have reacted to the economic pressure which had developed without a great deal of distress and a great many excellent cultivators suffering heavy loss. The position would, in his opinion, be worse if the State were to step in and control cultivation, and it did seem that these figures of production were the most complete and effective answer to those who would impose control.

He then referred to the improved position in regard to Foot-and-Mouth Disease, to the Order prescribing conditions for the transit of animals from Ireland and Overseas, to the progress made with the Rabbits and Rooks Bill, the Diseases of Animals (Amendment) Bill, the Destructive Insects and Pests Bill, and to the Royal Commission on Land Drainage which had been set up to examine as to the necessity of amendments in the drainage law of the country, stating that the

Ouse Drainage Bill would have to be pressed on without awaiting the result of the Royal Commission's inquiries. The efforts which were being made to improve the methods of marketing agricultural products, especially by demonstrations at the Agricultural Shows, were specially mentioned.

Government Meat Contracts.—Mr. H. W. THOMAS (Hants) asked as to the resolution of the last meeting of the Council on the question of the provision of British Meat for the Army, Navy, and Air Force. The MINISTER stated that the Services gave preference in all cases of contracts to home production, though that preference had to be limited to a reasonable percentage. It was not possible to give the exact figures to which the Services were prepared to go to carry out that preference, but at the present time there was such a difference between home-bred and imported frozen meat that they could not see their way to face the heavy additional expense which would be involved in changing their source of supply.

Ouse Drainage Bill.—Sir DOUGLAS NEWTON, M.P. (Cambs), inquired whether it would not be possible for the Minister to defer the decision as to the proper basis of the rate to be levied under the Ouse Drainage Bill until the Royal Commission had reported. The MINISTER said he was sorry he could not comply with the request. It was no new principle that was proposed to be adopted. It had been recommended by various Commissions in the past, and it had been adopted in certain Local Acts. The County of Middlesex, for instance, rated by means of the ordinary county rate the whole of the county area for the purposes of land drainage within their area. At the same time, the House of Commons would no doubt very carefully examine the basis before they decided whether or not it was applicable to the Ouse area, which was a very special one. In it, without the extensive embankments to keep back flood waters, nearly 400,000 acres would return to the state of a morass. The problem of the drainage of that area was largely caused by the waters which came from a district far above the level of the floods. If it was a matter of getting rid of only the waters which fall on the Fens it would be comparatively easy to pump them out into the tidal water, and for them to be carried away without any danger. Complicated and expensive work was largely caused by the fact that in the flat areas there was an enclosed space between the embankments which had to provide for flood waters coming down from the uplands. It was quite true that the ratepayers in those uplands did not get direct individual benefit, but very direct and definite expense

was caused to someone in getting rid of that water, and it seemed a perfectly reasonable and just principle, and a principle which has been accepted over and over again in our recent legislation, that a communal contribution should be made for this public service.

Agricultural Credit.—The Rt. Hon. Sir FRANCIS ACLAND, Bart., asked whether the Minister would deal with the question of Agricultural Credit in his Statement, or await the Resolution on the Agenda. The MINISTER said that on this subject he had at present nothing to add to the answers which had been given in the House of Commons. Negotiations between the banks, the Treasury, and others and efforts to solve the difficulties which had arisen were still going on. There was no possible chance of legislation this Session, but as soon as any decision was arrived at, it would be communicated to Parliament. Mr. ASHBY inquired whether the position in regard to negotiations had improved in the last six months, and whether the idea of the chattel mortgage had been entirely dropped. The MINISTER replied that certain modifications were being put forward as regards the chattel mortgage. He did not think it would be useful to give exact details as to the stage the negotiations had reached.

Urea as a Fertilizer.—Sir DOUGLAS NEWTON, M.P., moved the adoption of the Standing Committee's Report on the use of urea as a fertilizer. The Report recommended that the Government should take steps to make the fertilizer immediately available for farmers in this country. Lord BLEDISLOE, Parliamentary Secretary to the Ministry said that in view of the difficulty of producing electricity in this country at a relatively low cost as compared with Sweden or Switzerland it was quite possible that Urea could not be produced here at so low a cost as in those and other countries with similar advantages. It came under Part I of the Safeguarding of Industries Acts as a synthetic organic chemical and paid a duty of 33⅓ per cent. It could be exempted from that duty for such period as the Treasury might specify in an Order made after proper inquiry into certain points as directed by the Finance Act. The President of the Board of Trade would be consulted to see what could be done along the lines suggested in the Report. The Report was adopted.

Ministry's Report on Fruit Marketing.—Sir FRANCIS ACLAND moved the adoption of the Standing Committee's Report, which was carried. The Standing Committee stated that the Report was well ordered, well produced, and well illustrated, and was a

straightforward record of inquiry into the sources of production of our fruit supply, its preparation for the market, and the methods by which it is sold. The questions of transportation, and, where they are employed, the methods of preservation, including canning and bottling and storage, were dealt with in the Report, and the Standing Committee concluded that the consideration of a survey of that kind could not fail to stimulate those engaged in the industry to greater efforts to reduce their costs and so make their industry more profitable or more able to compete successfully with outside competition.

"The Agricultural Output of England and Wales."—Sir FRANCIS ACLAND moved the adoption of the Standing Committee's Report, which was agreed. The Report stated that the volume published by the Ministry was one of great interest, giving a detailed comparison of the position in 1925, not only with that of the last complete census in 1908, but with those in preceding and intervening years. The main figures of the report referred to the agricultural area, the number and size of agricultural holdings, the production and distribution of crops, the number and distribution of live stock, the output of live stock products, and the value of the agricultural output. Careful estimates were made of the number of persons engaged in agriculture. And for the first time figures were recorded as to the rent and value of agricultural land, the capital employed in agriculture, and the motive power used on farms. A final chapter dealt with agricultural prices. In dealing with such a work, it was impossible to summarize the figures, but a few extracts and analyses of figures were given which illustrated its scope and summarized certain outstanding tendencies in our agricultural development. They indicated, in the opinion of the Standing Committee, the desirability of a study of the publication in detail by all interested in agriculture. The Committee recorded the opinion, however, that the value of the publication would have been even greater if Scotland could have been included in its scope.

Hertfordshire Rural Education Syllabus.—Mr. DENTON WOODHEAD moved the adoption of the Standing Committee's Report which recommended the sending of the Syllabus to other County Education Authorities in England and Wales. The Report pointed out that the Syllabus was specially designed to bring into the curriculum of public elementary schools in rural districts teaching on rural subjects, including visits to farms and rural industrial centres, and the careful

observation of a large variety of farming and other rural operations. Mr. DENTON WOODHEAD said that the scheme proposed the giving of special attention to agricultural and country operations in the school curriculum at an age when children were very susceptible to such impressions. That kind of education would be useful to them all through their lives. He paid a special tribute to Capt. Morris, the Chairman of the Hertfordshire Agricultural Education Committee, in connexion with the preparation of the Syllabus. Mr. R. G. PATTERSON (Staffs) objected to bringing in too strong a rural bias into country children's education. Mr. W. HAWK (Cornwall) did not think the objection applied to this particular scheme. Mr. W. MCCRACKEN (Cheshire) considered that the careful selection of teachers for rural schools was very important. At present rural schools were suffering because they did not get such good teachers as the town schools on account of the smaller salaries offered. The Cheshire Education Committee were obliged to offer larger salaries for rural teachers. Sir MERRIK BURRELL (West Sussex) expressed the view that the word "bias" in this connexion was wrong. It was necessary to train children to understand their own environment and to teach them in terms of the conditions under which they lived. Mr. CHRISTOPHER TURNOR raised the question of the means of circulation of the Report, and it was suggested and agreed that the Council of Agriculture should do it.

Importation of Canadian Cattle.—Sir MERRIK BURRELL moved :—

> That the Council of Agriculture for England considers that the statement of the Free Importation of Canadian Cattle Association of Great Britain that 50 per cent. of British dairy cattle are tubercular is unjustifiable, inaccurate, unsupported by any evidence or authentic figures, and is merely a biased estimate calculated to mislead uninformed opinion: furthermore, that there is no reason to suppose that Canadian cattle possess any greater resistance to bovine tuberculosis than British cattle if exposed to infection. The Council is of the opinion that any further relaxation of the present Orders governing the importation of cattle into Great Britain would cause grave injury to the cattle breeding industry and in no way benefit the supply of meat or milk to the population of this country either as regards price, quantity or quality.

After dealing generally with the position under the Tuberculosis Order of 1925, by which animals in an advanced state of tuberculosis are required to be slaughtered, and rebutting the statement in question, Sir MERRIK added that if Canadian cows were found to be free before importation he saw no reason why they should be more immune to tuberculosis in this

country than our own cattle. Lord BLEDISLOE, on behalf of the Ministry, said that it agreed with the substance of the first part of the resolution, and, as regards the second part, the Ministry had no intention of altering its present policy. There were no authentic or official figures giving 50 per cent. of British dairy cattle as being affected with tuberculosis. Indeed, the statement was seriously inaccurate and in its implication grossly misleading. Existing figures showed that about 1 per cent. of the dairy cattle, actually tested, showed signs of being definitely dangerous to human life in respect of the milk supplied. This was a very small proportion of the total dairy cattle. The motion was put to the meeting and carried.

Agriculture and Safeguarding of Industries.—Sir GEORGE COURTHOPE, M.P., moved :—

> That this Council, while recognising the value of recent Agricultural legislation, is convinced that its effect upon the present economic position of Agriculture is insufficient to maintain food production and rural employment, and further legislation of a far-reaching nature is urgently required for this purpose. In view of the increased production and employment which has been promoted in other industries by the Safeguarding of Industries Act, and other protective measures, without increase of cost to the consumer of the articles produced, this Council urges His Majesty's Government to extend the operation of this Act to Agriculture, in order to maintain and increase the production of those classes of farm and garden produce which are most seriously threatened by foreign competition.

In the course of his speech, Sir GEORGE COURTHOPE drew attention to the fact that the McKenna duties and the Safeguarding of Industries Act had been successful as applied to other industries and had shown that it was possible for Protection if wisely applied to increase production and employment, and to produce revenue without necessarily increasing the cost to the purchaser of the goods produced. It was inevitable that this safeguarding should be extended to other industries; and why not to Agriculture? He would be the last to ask the Government to depart from the solemn pledge to the Country at the General Election that it would not increase the general volume of taxation by taxes on food. It should be remembered, however, that over 24 millions a year addition to the revenue resulted from taxes on tea and sugar alone. He asked the Government to consider whether it could not, consistently with its mandate from the people and with the pledge which had been given, substitute food taxes which would have a protective effect for food taxes which had none. The resolution was seconded by Capt.

MORRIS, who appealed to all parties to come together with an earnest endeavour to place Agriculture on a sound basis of prosperity.

Lord STRACHIE (Somerset) moved an amendment that as the Government had declared against Protection for Agriculture the Council should rather urge it to lighten the heavy burdens of Imperial and local taxation on agricultural land. He drew attention to the large increase in price which had resulted from the application of the Safeguarding Act to gas mantles and to the fact that unemployment in the motor and silk trades had increased after safeguarding. Dealing with Protection he said it could be summed up in the words of Lord Balfour :—

> "What is a Protective policy ? A Protective policy, as I understand it, is a policy which aims at supporting or creating home industries by raising home prices. The object of Protection is to encourage home industries. The means by which it attains that object is by so arranging import duties that the prices obtained in those industries are increased. If home prices are not raised, industry is not encouraged. If industry is encouraged, it is by raising prices. That is, in a nutshell, Protection properly understood." —(*Lord Balfour at Edinburgh, October* 3, 1904.)

A remedy for the agricultural situation might be to bring the grants under the Agricultural Rates Act, 1896, up to the full amount of the rates. Agricultural land should be treated in the same way as the raw material of a manufacturer.

The amendment was seconded by Sir FRANCIS ACLAND. He thought that protection was bound to increase prices. Mr. Ritchie's registration duty on corn was repealed because it had influenced prices in the upward direction. The suggestion of transferring the duty from the articles already taxed to agricultural commodities needed no discussion. A duty on tea went all to the Exchequer, a duty on corn went partly to the Exchequer and partly to the English farmer, and there must be a far larger burden to obtain the same result. The only way in which Parliament could help the industry was to help it to help itself. Mr. C. B. FISHER (Northants) drew attention to the risks of dumping, an example of which occurred in 1923 with potatoes, when the consumer did not reap the benefit of the lower prices. Mr. R. P. ALLSEBROOK (Leicester) held that imported skimmed milk should be taxed. Mr. CHRISTOPHER TURNOR said that if agriculture was to be left to work out its own salvation it must not be handicapped. There was the present fixation of minimum wages and he did not

think it possible to make arable farming pay at the present time if wages were more than £2 an acre. All were in favour of raising the standard of living of the working people, but if that were done the industry must be helped to maintain that standard. In other countries employees were working longer hours and getting one-third of the British wage. Mr. R. G. PATTERSON said that Protection was of no use to the farmer unless it did increase his prices. He thought the country had to consider whether it was fair to see agriculture go down, with the result that the control of prices passed entirely into the hands of the exporting countries. If agriculture were ruined, these exporters would have no mercy on the British public. The MINISTER said, with regard to the amendment, that the State was now contributing under the agricultural rates relief grants alone about 4½ millions a year, with the result that the rates on agricultural land come now about the same as in 1896, whereas the rates on other property had increased fourfold. As to the original resolution, he agreed with Sir George Courthope that the particular details of the method of applying Protection to Agriculture were relatively unimportant, and at this stage Sir George only wished the Council to accept the position that our tariff arrangements should give special assistance to the industry. As mover, Sir George had based his case very largely on the opinion that the safeguarding duties had not in fact increased the cost to the consumer. In the Minister's view the consumer paid differently in different cases. In the motor industry, where the powers of production in this country were so great that it was independent, the foreigner had to pay the duty if he wished to enjoy the market. That result would not necessarily follow in the case of some other commodities in which the country was not self-supporting, as, for instance, wheat, where the foreigner might not consent to send it unless the country was prepared itself to pay the extra cost of the tax. The kind of Protection which would not raise prices would not help the farmer. The Minister further discussed the question from the political aspect and pointed out that the proposal was not, in fact, practical politics. He added that, in view of the importance of Sir George Courthope's resolution, he had taken the occasion to consult the Cabinet specially on the subject and he had its authority to say "*That the Prime Minister's pledges at the General Election stand, that the White Paper on Agricultural Policy of February*, 1926, *stands as the Government's considered policy, and that the Government is unable to depart from the conclusion, at which it arrived after careful and anxious considera-*

tion, that it cannot give assistance to agriculture by means of protective duties."

Lord Strachie's amendment was put to the meeting and lost by 33 votes to 13, and the original motion was put to the meeting and carried by 30 votes to 14.

Improving Transport in Country Districts.—Mrs. HUGH MIDDLETON moved :—

> That this Council respectfully requests the Minister of Agriculture to do all in his power to enforce the recommendation contained in Paragraph 37 of the Report on Agricultural Policy agreed by this Council on August 6, 1925, and presented at that time to the then Minister of Agriculture.

She said that in the purely agricultural part of the country where she lived the inhabitants had been deprived of a 'bus service which was really helping them in many ways. The Minister of Transport had said that if it were proved to him that the deprivation was a mistake he would not stand to it. She thought the Minister of Agriculture could prove to the Minister of Transport that he had made a mistake and she, therefore, brought the matter forward under this general resolution. Sir FRANCIS ACLAND seconded the motion, which was put to the meeting and carried.

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POULTRY KEEPING ON A SMALL FARM IN OXFORDSHIRE

G. AND F. HENDERSON.

Introduction.—This is a holding of 85 acres, of which 60 are arable land. It is situated, 500 ft. above sea level, in the parish of Enstone, midway between Oxford and Banbury, and eight miles east of Chipping Norton. The land is well watered by springs which never run dry, and, in this respect, the holding is singular for the district, most of the surrounding, and much larger, farms depending on water that has to be pumped by wind or ram over considerable distances.

When the farm was taken over, some three years ago, there were from four to six different crops in each arable field ; but it is hoped by next year that it will be possible to work on a five-course rotation : roots, barley, oats, seeds, wheat. Being limited in area, the grassland carries, usually, only a few calves and a cow or two in addition to two horses and some sheep, the last item being represented this year by 36 Kent lambs.

A varying number of pigs are kept, but no sows, the grass not being suitable for running before farrowing. From 10 to 50 store pigs are purchased in the spring, number depending on prices of feeding stuffs and fat pigs, and these are run in the yard during the summer. By the above means, straw is being trodden into manure all the year. In addition to the two horses, a tractor is kept. With the exception of threshing time, when some casual assistance has to be obtained, all labour is furnished by the two owner-occupiers.

POULTRY.

Accommodation.—In one grass field of 13 acres, sloping towards the west, there are three fowl-houses, spaced 60 yards apart, each of which holds 120 birds comfortably. The construction of these houses, which are home-built, is described later, and illustrations are given in Figs. 2, 3, 6, and 7. It is hoped in the near future to erect another five of these laying-houses, which will bring the total accommodation up to about 1,000 birds, allowing 3 sq. ft. of scratching space to each bird. There are also some ordinary small poultry-houses for rearing chickens.

Breeding Stock.—The original stock was purchased from a large pedigree breeder. The number of pullets being increased annually and, therefore, needing more cockerels, the latter are hatched from eggs purchased each year from well-known breeders. In this way it has been possible to keep the flock up to a high standard although mass mating is practised. Replacing the cockerels each year has been found necessary, it being practically impossible to put cockerels with year-old cocks, the latter fighting the cockerels until they will not go near the hens. About 100 to 150 eggs are purchased in January, and out of the chicks, which are reared separately, there are usually 50 to 60 cockerels, from which the required birds are selected.

The present stock consists of 250 Light Sussex pullets and 100 Light Sussex hens. These are mated with Light Sussex cocks, of which 20 are required. The egg average last year was 170 eggs per bird.

Foodstuffs and Feeding.—It will be noted that the prices for foodstuffs, given later, are rather cheaper than is usually quoted. They are, however, mostly home-grown, and the prices given are those that at the time were obtainable on the farm. As far as possible, home-grown corn is used. The ground oats for the mash are home-grown, and are ground

at a neighbouring mill. Bran, toppings and fish meal are purchased each month, and, whenever possible, are bought along with artificial fertilizers or cattle cake, so that a two or four-ton truck can be made up and carriage saved.

The adult birds are fed twice a day, the morning meal being a mash. This is similar to that given to the chickens (described later) except that it is mixed with water instead of milk and that the fish meal is increased to 15 per cent. during the winter. Two ounces is allowed to each bird, weight before adding water. The second feed consists of wheat during the summer; and as the season advances cracked maize is introduced, the latter being increased until all maize is fed in the winter.

Incubators and Hatching.—The incubators comprise three hot-air and two hot-water machines, having a total capacity of 1,500 eggs. They are housed in the barn which, of course, is no longer used for stacking corn; but, to provide floor space for storing feeding stuffs, etc., an upper floor, 6 ft. from the ground, has been erected in it. Notwithstanding the fact that the temperature in this building is usually between 40 and 50 deg. F. during the hatching season, the hatching average last season was 72·37 per cent. for hens' eggs and 76 per cent. for ducks' eggs.

The incubators are started in November, and take all the first grade eggs from the stock at the beginning of the hatching season. The chicks hatched from November until February are not for stock, but for marketing as "spring" chickens. The stock birds are hatched from February until April, and about 5,000 day-old chicks are sold, there being a ready sale in the locality for these at 12s. per dozen for the early hatches, the prices being reduced as the season advances It is usual, in fact, to be booked up for them several months ahead.

Rearing "Spring" Chickens.—The early hatchings for the "spring" chicken trade are reared, in lots of 100 to 150, in ordinary small poultry houses, with the aid of small hovers. The birds are taken from the incubators as soon as dry and placed under the hovers, only water and fine limestone grit being given for the first 48 hours. Any small or weakly chicks are killed on the second or third day, as they do not pay for rearing. The first feed mixture is composed as follows:—

3 parts cracked wheat.
1 part cracked maize.
1 part coarse oatmeal.
2½ per cent. each of linseed and hempseed.

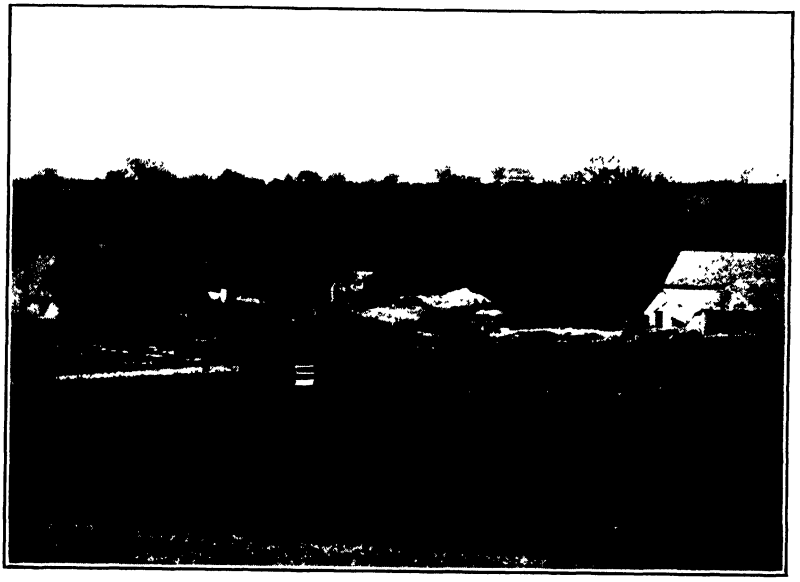

FIG. 1.—General view of the Farm.

FIG. 2.—Interior of a laying house.

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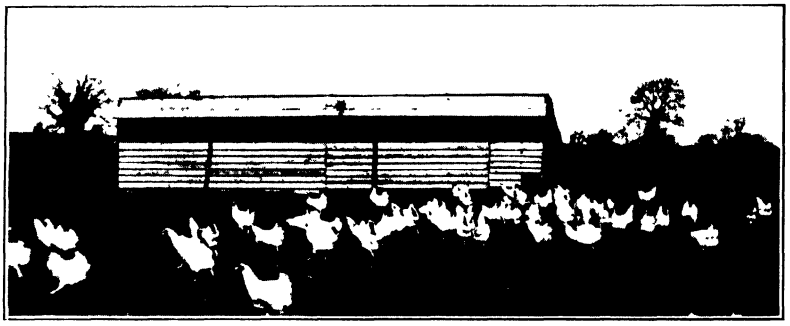

FIG. 3. -Exterior of a laying house.

FIG. 4. Two of the brooder houses and pens, containing over 600 eight-week old chicks.

FIG. 5. The incubators, in which over 5,000 chicks are hatched each season.

This mixture, alone, is fed during the first ten days, every two hours from 6 a.m. to 6 p.m., the first and last feeds being in artificial light, using a hurricane lantern. On the eleventh day, two feeds of mash are introduced, made up as follows :—

1 part Sussex ground oats.
1 part bran.
1 part toppings.
10 per cent. fish meal (the best obtainable).

The mash is mixed to a crumbly state with milk, and the number of feeds are increased until such time as the chicks are having half mash and half grain mixture. By feeding in this manner it has been found possible to get the cockerels up to 3½ lb. in four months, without cramming or special feeding. Chicks for stock are reared in the same manner.

Cost of Rearing "Spring" Chickens.—To get a fair idea of the profits that can be made from the rearing of this class of table poultry, a special account was kept last year of the cost of one batch of chickens. This worked out as follows :—

	£	s.	d.
120 eggs at 3s. per dozen	1	10	0
Oil and wick for incubator	0	6	0
Oil for brooder	0	4	6
8 cwt. of mash at 12s.	4	16	0
8 cwt. of grain at 13s.	5	4	0
Total	12	0	6

Ninety-one chickens were sold, of a total weight of 260½ lb., at 2s. per lb., totalling £26 1s. 0d. The expenses of selling, transport, etc., were £2, so that it will be seen that there was exactly 100 per cent. profit on the outlay. This result was checked by the figures of the final account for all the chickens reared last season, which showed almost 100 per cent. profit on the outlay, out of which to meet the costs of labour, depreciation, risk, return on capital, etc. This seems to show that there is a promising future for table poultry.

Marketing.—The fat chickens are taken to London (a distance of about 70 miles) by the farm lorry once a week, together with eggs. Some of the chickens are sold dead (rough plucked), but on account of the difficulty of getting them plucked locally, a larger number are sold alive, and this does not make a big difference to the price realized. It would make a considerable difference, however, if the live birds were sent by rail, the rail charges for live birds, also for returned empty crates, being heavy. By using lorry transport, it is as cheap to take live birds as dead ones, and this method has the advantage of bringing the owners into personal touch

with the buyers, whose requirements are thus ascertained. The London price for chickens is usually considerably higher than that obtainable locally. In the case of eggs, which are sold, under a yearly contract, to a large London dairy firm, there is often a difference of 6d. per dozen, after deducting carriage. The chickens are sold to retail shops and hotels.

Ducks.—There is also on the farm a flock of White Runner ducks. These have drakes running with them to ensure that the eggs are fertile, this being essential, as the incubators are filled with duck eggs as soon as it is too late for hatching chickens. Most of the ducklings are sold as day-olds, the price being 12s. per dozen. The demand for these is not so great as for chicks, but no difficulty has been experienced in disposing of them.

The flock average for the ducks last year was 180 eggs per bird, the greatest number in one month being 1,022 in March.

To ensure that all eggs are laid in the duck house, which is 10 ft. square, with a board roof, the ducks are kept indoors until 9.30 a.m. They then roam over the grass and arable land (it is surprising what distances they will travel after worms, insects, etc.), but when the corn is in ear they have to be kept off the arable by sheep netting, for they will spoil acres of corn. Just before sunset they are called in and given a mash (3 oz. per bird) of the same ingredients as that for the fowls, except that the fish meal is increased to 20 per cent. during certain times of the year.

Laying House for Fowls.—The home-built laying house, shown in Figs. 2 and 3, is 28 ft. long by 14 ft. deep (over-all dimensions), and costs about £16 to build, exclusive of labour. It can be erected by anyone who is sufficiently handy with saw and hammer to repair fences. The timber required is as follows :—

1,200 ft. run 2 in. × 3 in. framing.
1,400 ft. run 7 in. × ⅞ in. grooved and tongued boarding.
2,000 ft. run 7 in. × ⅞ in. weatherboarding.
250 ft. run 1¾ in. × ¼ in. battening.

These are the scantlings of the timber used for the houses on the farm, and, if thought insufficient, it may be said that the houses stand in an open field, 500 ft. above sea level, and have stood against all winds for many months. The method of erection is described below, the first operation being to construct four frames of the 2 in. × 3 in. timber, shown as A, B, C and D in Fig. 6. The general arrangement of the parts of the house are shown in Fig. 7.

Frames.—Frame A, the front of the house, has six uprights, each 7 ft. 6 in. high. Lay these on the ground, spaced 6 ft.

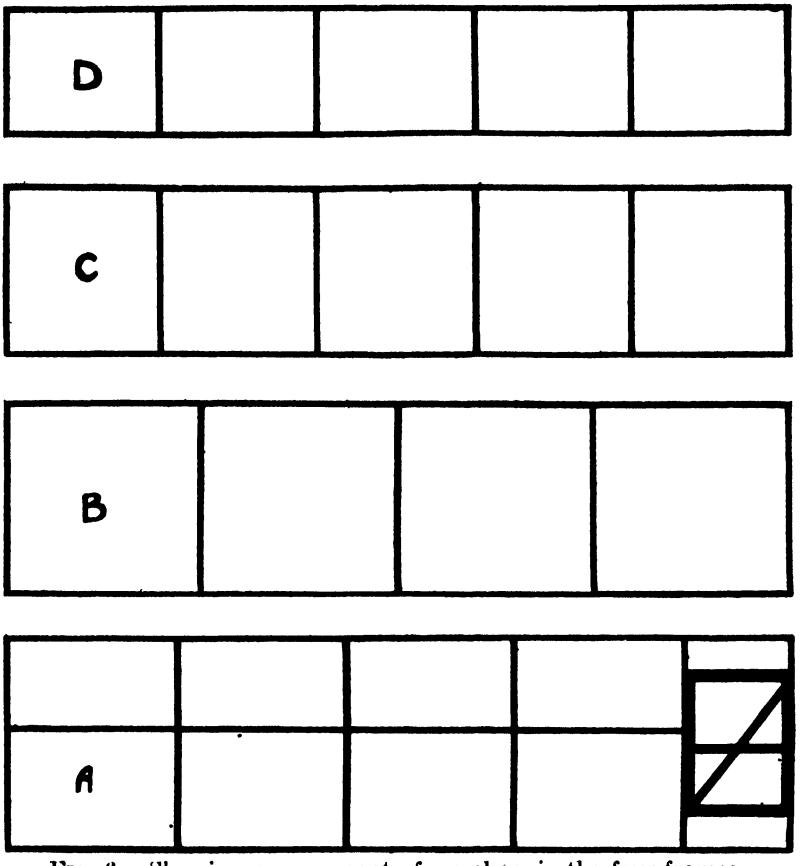

FIG. 6.—Showing arrangement of members in the four frames.

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apart, except the two at the right-hand side, which should be spaced 3 ft. apart to form doorway. Top and bottom pieces or plates should then be nailed respectively to the tops and bottoms of these uprights. Make a centre rail by fixing pieces between the uprights at a height of 4 ft. from the bottom. From base to centre rail cover with weatherboarding, and from centre rail to top with wire netting.

Frame D, forming back of house, has six uprights, each 4 ft. long. Construct as A and weatherboard from base right up. When completed these two frames should be set upright in position (it will need two men to do this), care being taken to see they are exactly 13 ft. 6 in. apart in the clear. The frames can be stayed in position by temporarily half-nailing a few planks to their tops and sides.

Frames C and B, intermediate between A and D, give support and stiffening to roof and sides, and are similarly

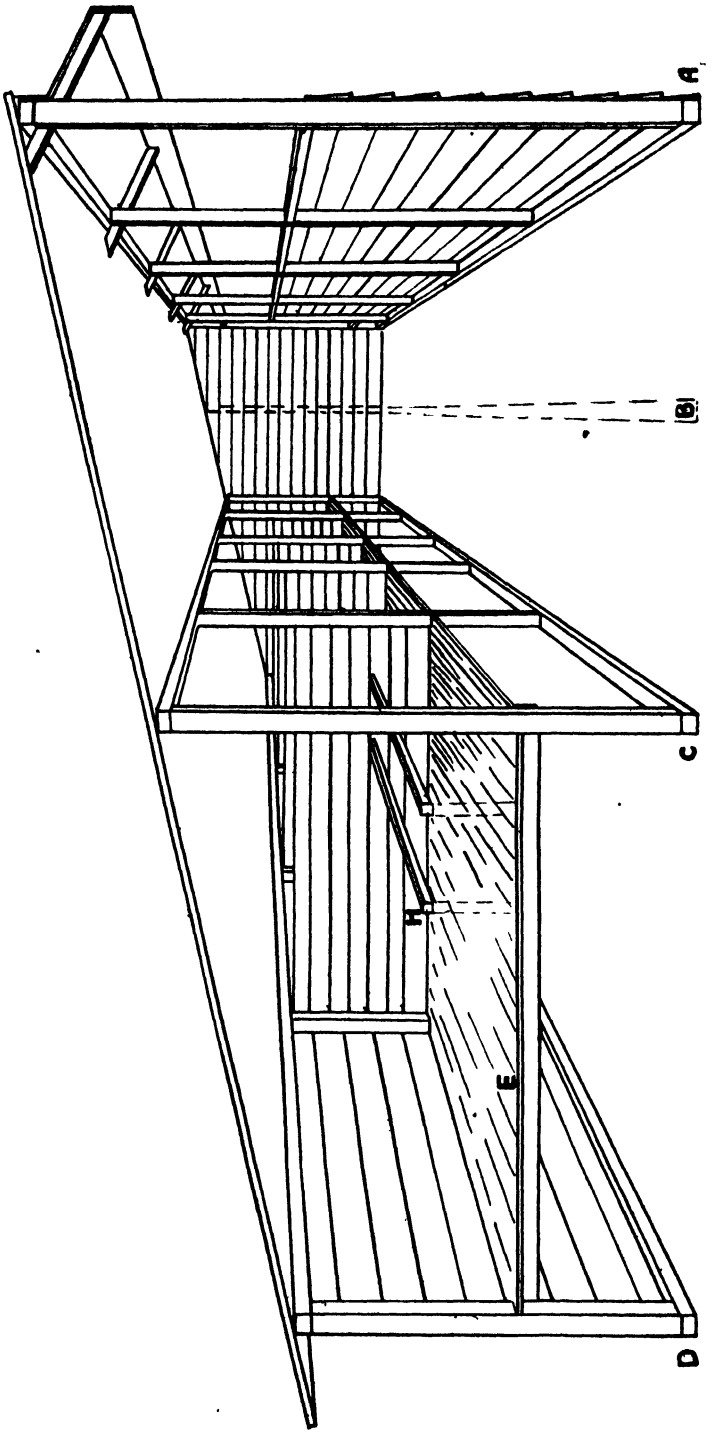

FIG. 7.—Interior of laying house, showing method of construction.

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constructed, C having uprights 6 ft. high and B uprights 7 ft. high. The distance between C and D, when in position, should be 5 ft. 4 in., and between C and B and between B and A, 3 ft. 10 in., all dimensions in the clear.

Ends and Roof.—When the four frames are in position, weatherboard the sides up. Cover the roof with the grooved and tongued boarding, giving an overhang at the back to throw drip clear of back wall. Over boarding, lay felt lengthways, beginning at back and giving a good lap, say 4 in., of each width over the preceding one. Further secure felt with strips of the battening, nailed on, parallel to the slope, 2 ft. apart. The hood, fixed over wired opening of front to prevent ingress of rain, is supported on bracket pieces, 2 ft. long, nailed to uprights of Frame A, as shown in Fig. 7. Nail one row of weatherboarding to ends of brackets along front, and two rows on top of them.

Floor.—Of rammed earth, stones or concrete. Last is best, but rammed earth will do, provided site is fairly dry and plenty of litter (straw or chaff) is used, and renewed frequently.

Interior Fitting.—Dropping boards (E) are of grooved and tongued boarding, ends being fixed to bearers which are nailed to uprights of frames C and D, about 2 ft. 6 in. above ground. Division partitions (H), to prevent wind blowing over the birds at night, are also of grooved and tongued boarding, nailed to uprights of C and D above dropping boards. If the house is very exposed, four of these divisions may be required; in very sheltered positions one should suffice. Perches, which should have top edges rounded, are fixed between the divisions.

Nest Boxes.—Can be made, against the front, with odd pieces of wood. They should not be less than 1 ft. square, and fourteen nests will be sufficient.

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WOOL FROM RABBITS

W. KING-WILSON,

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THE years since the war have seen rabbit breeding in this country develop from a hobby, and a small addition to the food supply, into the status of an industry. Expansion has been along two distinct lines, the one being the production of pelts and flesh, the other the production of rabbit "wool." For the former purpose the rabbits have, necessarily, to be killed to obtain the marketable products, but in the case of

wool production the life of the animal is preserved for the growing of successive coats of the wool.

The Angora Rabbit.—The Angora breed of rabbit alone grows a coat of sufficiently fine texture to merit the appellation of "wool." The name is popularly supposed to indicate the place of origin of this particular breed, but the fact that goats associated with the town of Angora have fine, silky coats may give it another significance. If Asiatic Turkey, however, can claim to be its original home, the Angora rabbit must, in the distant past, have spread to the adjoining continent, for it is now to be found in most European countries. It has been bred in the United Kingdom for many years, but France appears to have been the first to breed it on commercial lines, using the wool for the making of wearing apparel. Her example has now been followed in this country, and the British wool, being held, in the trade, superior in quality and capable of extended use, commands a higher price than the French article.

White Angoras are more popular for wool production than those with coloured coats, although the mills will purchase blue, black, fawn and grey wool on similar conditions to the white. The white Angora rabbit is an albino, its beautiful, thick coat contrasting with the "eye colour"; and its wool, of very fine texture, may attain a length of as much as 9 inches if allowed to grow to its full extent. Tufts of the fluffy wool in many cases surmount the ears of prolific wool-producing Angoras, while a forelock may hang down between the eyes, and the hair may also grow freely on the feet in the tufted manner. Although these tufted Angoras are frequently found in purely commercial rabbitries, there are many good specimens which do not carry such prominent "furnishings." The animal does, however, give the impression that it carries thousands of fibres to the square inch upon back, sides and much of the under part of its body. The arrangement of the fibres is also noteworthy, there being, scattered about amongst the bulk of the coat, longer and stronger fibres which help to protect the remainder of the wool from contact with dirt or contaminating matter and also from wear. If one of the finely textured fibres is isolated and closely examined it, will be seen to be crinkly; and it is this preponderance of zig-zag, or crinkly, appearance, which distinguishes the English Angora rabbit wool from that produced by the breed on the Continent. The fecundity of the Angora rabbit is normal, while the does are efficient mothers.

Housing and Feeding.—Hutches for woolling Angoras may be of several different kinds; the general type used for other

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A litter of six young white Angora rabbits. Although these appear to be quite large, their bulk is mainly "wool."

The modern rabbitry at the National Institute of Poultry Husbandry, Harper Adams Agricultural College. The hutches are arranged in stacks, three tiers high, there being one large door to three hutches, the working of the rabbitry being appreciably facilitated by this means.

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breeds is, however, quite suitable. Some commercial plants have hutches with perforated floors, and other special hutches may be used if there is a difficulty in securing suitable litter. The hutches need not be expensive, but they should be proof against both draught and damp. If they are arranged in a building, the conditions are more pleasant and suitable for efficient working, but the rabbits will thrive quite well without the hutches being under cover.

For bedding and absorbent material, straw and chaff can be used if other litter is not available; but for commercial use the most suitable litter is wheat straw. This can usually be obtained without much trouble in most districts, and if it is free from weeds and soil it assists very materially in keeping the wool free from dirt and matting.

Foodstuffs which are generally available on farms are suitable for the breed, the bulk of the ration being of a vegetable nature. Of this, hay and green foods, with roots in winter, form the largest part so far as bulk is concerned, whilst concentrated material, such as whole cereals and miller's offals, supply the remainder of the popular rabbit ration.

Care and Treatment of the Wool.—In the production of Angora rabbit wool, it is not necessary to grow the wool to its full natural length. The spinners ask for wool of 2½ to 3 inches long; and, as this length of staple can be grown in about three months, it is usual to secure four crops per year from woolling rabbits. During the third month of growth, it is customary to groom the wool in order to keep it as clean as possible. There are two practical ways of grooming; the more general method is to brush the coat with a small bristle brush having a pneumatic cushion, which is made for this special purpose. The other method requires the use of an automatic blower or fan, which has some resemblance to the drying apparatus used by hair-dressers. Such a machine is expensive, however, and only likely, therefore, to interest those who keep large stocks of Angoras. The rabbits may be kept clean with the special brush, if they are groomed for two or five minutes every second or third day; but, on the last two days previous to taking a wool crop, rather more time and attention should be given to the operation.

The crop of wool may be obtained either by clipping or plucking, but very few people in this country pluck their rabbits. Plucking only becomes possible when the coat has grown to its full natural length, and has ripened in readiness for

a moult. Clipping, on the other hand, is possible whenever it may be needed. As soon, therefore, as the coat reaches the length most suited to the requirements of the spinners, namely, 2½ to 3 in., the crop of wool is shorn off. The shearing is performed with a pair of scissors, those with tapering blades, such as barbers use, being quite suitable. By parting the wool down the back of the animal, the operation can be commenced without difficulty. Should the rabbit happen to carry a little unclean wool, the crop should be carefully graded, the process being quite simple if carried out at the time of gathering the wool. Any soiled or damaged wool can be placed on one side or in a special receptacle as it is shorn off, and the clean crop can then be packed away in a box, jar or tin until sufficient has been accumulated to make a suitable consignment for disposal.

Value of the Wool.—The price now paid by the spinners for first grade British Angora rabbit wool is thirty-four shillings (£1 14s. 0d.) per pound. To rank as first grade, the wool must, obviously, be clean and free from matts or clotted sections of fibre. Wool containing vegetable matter or which is slightly stained is graded second or third quality, according to the degree of damage, and the price paid is reduced accordingly. First grade wool is that most sought after by the manufacturers, and it is this grade which yields the best return to the rabbit owner. Since the maintenance of a good rabbit is unlikely to cost more than a bad or indifferent one, the wisdom of breeding only from suitable breeding stock can scarcely be overemphasized. The amount of wool grown by individual specimens naturally varies, but mature animals are quite capable of yielding from 8 to 10 oz. in one year. Where special attention is given to small stocks, heavier yields may be secured, but such cases cannot be considered in relation to the general average of wool growers.

Utilization of the Wool.—The wool is spun at the mills into a yarn, the resulting manufactured "wool" being used principally for knitting articles of clothing for women and children. Little suits for infants are frequently made of this material; but other articles, such as hats, caps, scarves, jumpers, dresses, suits, gloves, socks, etc., are also manufactured of rabbit wool, and are of sufficient strength to withstand certain processes of washing.

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CANADIAN WHEAT POOLS

(The following statement, descriptive of a Canadian Wheat Pool, has been supplied to the Ministry by the Canadian Co-operative Wheat Producers, Limited, and may be of interest to farmers at a time when the possibilities of central selling, through organizations of this type, are under discussion.)

THE Canadian Wheat Pool is a non-profit co-operative association with a membership of 138,000 farmers in the three prairie provinces of Manitoba, Saskatchewan and Alberta. There are three provincial pools, each one a separate entity, self-controlled in every respect, with its own plan of organization and management, its own officials, administering its own internal affairs and collecting its own grain. The Central Agency handles the grain collected by the three pools. This Central Selling Agency handled during the crop year 1925-26 the enormous total of 215,016,000 bushels of grain, made up of 187,500,000 bushels of wheat, 11,024,000 bushels of oats, 13,221,000 bushels of barley, 1,597,000 bushels of flaxseed and 1,674,000 bushels of rye.

The three provincial wheat pools handled more than 56 per cent. of the entire wheat crop of Western Canada. The approximate gross returns to the provincial pools was $271,500,000, of which $22,500,000 went to Manitoba, $188,500,000 to Saskatchewan, and $60,500,000 to Alberta. This did not, of course, all go back to the farmers, as it included, for example, freight and local handling charges on wheat shipped through private elevators. Of the grain handled, 27,000,000 bushels went through pool terminals. Shipments were made to 25 different countries. The overhead selling cost of the Central Selling Agency amounted to one-fifth of a cent per bushel.

The movement for a voluntary wheat pool was started as soon as the western farmers had to abandon their efforts for the re-establishment of the Dominion Wheat Board, which handled very much to their satisfaction the entire wheat crop of Canada in 1919. Organization campaigns were conducted in the three provinces in the summer and fall of 1923, with 50 per cent. of the wheat acreage in each province set as the objective.

The Alberta Pool was the first to commence operations, with approximately 46 per cent. of the wheat acreage of the

province for 1923, or a total of 2,602,797 acres under contract. The first carload of pool wheat was accepted on October 29, 1923, and the world's largest co-operative marketing enterprise had hung out its shingle and started on its business career. Both the Manitoba and the Saskatchewan Pool commenced operations the following fall [autumn].

Membership in the provincial pools is open to those who are directly or indirectly engaged in the production of wheat. Every member on joining the pools pays a fee of two dollars, which goes to pay organization expenses, and also pays one dollar for a nominal share in the organization, to comply with the company laws of the province. He signs a five-year contract binding himself to deliver all the wheat which he produces directly or indirectly to the pool. All present contracts terminate with the 1927 crop. Those who joined the pool since the first year have, therefore, signed only for the balance of the period. An exception to this is the case of members signing a contract with the Manitoba Pool in connection with the acquisition of pool elevators. All such contracts are for the full five-year period.

These contracts form the foundation of the organization, and through the democratic methods which prevail, in the election of delegates and directors to the central bodies, members are in continual touch with and control of the entire organization. Each provincial pool is self-governing, and while the general form of organization, the terms of the contracts, and the methods of business are similar in all three pools, there are certain differences in detail.

The provincial pool has complete control of its members' wheat from the time of delivery at the country point of shipment until it reaches the terminal elevators at Fort William or Vancouver, as the case may be. At these terminal points the grain is turned over to the Central Selling Agency, which is under the control of a board of directors consisting of nine members, three from each of the provincial boards of directors.

The federal charter for the Canadian Co-operative Wheat Producers, Limited, the official title of the Central Agency, was issued in August, 1924. The keynote of the whole movement is outlined in the second clause of this charter, which states the purpose of the Central Selling Agency as follows :—

> To be an agricultural organization instituted for the purpose of mutual help to serve as the Central Marketing Organization for the corporations and persons mentioned in Section A hereof, but for no others; to improve methods and reduce costs of marketing grain, to reduce speculation, manipulation and waste,

and all unnecessary transactions in such marketing; to increase consumption, build up new markets and develop new uses for grain; to market same directly and with regularity, so as to furnish it economically to the users thereof, and to preserve for the growers and the public their proper profits.

The Canadian Wheat Pool had no elevators when they started operations, but a clause in the contract provides for a deduction of two cents per bushel for the purpose of acquiring facilities for the handling of grain. The Saskatchewan Pool constructed or purchased outright 90 elevators in 1924-25, and by an agreement with the shareholders purchased in 1926 for a little over eleven million dollars the Saskatchewan Co-operative Elevator Company's system, and now owns and operates 587 elevators, including several terminals. The Alberta Pool already has 42 elevators under their control, and have now decided to build or acquire 100 additional country elevators in the province in time to handle the 1927 crop. The Manitoba Pool now owns 30 elevators, and should double this number by the end of the present year. In addition, the Alberta Pool has leased the terminal elevator at Prince Rupert, and another at Vancouver. The terminal elevators owned by the Saskatchewan Co-operative Elevator Company system are included in the deal of eleven million dollars between the pool and this company. The Central Selling Agency has three terminal elevators at Fort William, Ontario, with a total capacity of more than 2,000,000 bushels.

Referring to the relationship of the Central Selling Agency to the provincial pools, Mr. E. B. Ramsay, member of the Central Board, and secretary of that body, states :—

The Central Selling Agency is not an institution apart from the Provincial Associations, but is owned—lock, stock and barrel—by them. The ownership is based on capital stock, which is owned in the proportion of one-third by each of the three prairie pools, irrespective of the proportion of grain handled in the individual pools. The Central Selling Agency is directed by a Board which is nominated annually by the provincial associations, and each member pool nominates from its own Board three representatives. These nine men constitute the governing body of the Central Selling Agency, and this system enables the Provincial Boards to keep in close touch with all the policies and activities of the Central Selling Agency in a manner which would be impossible to a separate board of directors at Central. It also insures that the viewpoint of the country will be the guiding factor in determining the policies of the Central Board and maintains a unity throughout all pool developments which is an essential part of an organization that, in three short years, has developed business activities in all parts of the wheat importing world.

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JULY ON THE FARM

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Seasonal Notes.—The farm, whether pastoral or arable, looks its best in July. The horses have recovered the gloss that they lost during the pressure of spring cultivations; the cattle, including the yearlings, have put on their short, sleek summer coats and show the effects of Nature's best forage—June pasture; the cornfields are full of tall, waving verdure, and the root and potato crops begin to extend their rich foliage across the rows and cover the bare ground. The stack yard also looks less deserted than it did in June, some, if not all, of the hay harvest having been gathered in; and, if all has gone well during haymaking, time has perhaps been found to clean up, paint and put away in proper order, the various machines and implements that have been employed in the spring tillage operations.

July, however, gives an aspect to the countryside distinct from that of May and June. The trees and hedgerows now show a darker, more mature greenness, and, the mating season being over, the birds' songs have ceased. Pasture land enters on its second period, when the grasses tend to produce less leaf than during May and June and the clovers produce flower heads, which, while they yield the beekeeper his harvest, are perhaps not so valuable as leafy herbage to the grazier. Certainly the stock-carrying power of grass land is generally smaller in July than in June; and, where heavy stocking is practised, the farmer is glad when fattening cattle and sheep have made good progress, so that the pastures may be relieved of many of these before July is far advanced. In dry seasons, keep may begin to get short in this month and, whatever may be the virtues of nitrogenous top-dressings applied early enough, little relief is to be obtained from their application to short pasture during a dry period; in fact, I have known sulphate of ammonia produce a scorching effect when applied under these conditions.

The weather of this month is subject to wide variations, but most farmers, excepting those wholly dependent on cattle fattening, prefer a moderately dry month. The bulk of the hay is made in July; the final cleaning and horse-hoeing of the root crops cannot be done effectively in constantly wet weather, and the bare-fallow may be almost a failure if the sun lacks its customary July power; but the dread of wild wet weather in this month is proverbially expressed in the

old couplet," No tempest, good July, lest the corn look ruely." In this month corn crops go through the process of transferring food materials from their leaves and stems to the ears. Moisture is essential to this process and, as is well known, weather which is too hot and dry, and which brings harvest time forward too rapidly, results in light, husky grain, and light yields. On the other hand, when the crop becomes laid, the loss due to badly fed grain is aggravated by the increased cost of harvesting and by the dragging on of the harvest season, so that little opportunity is left for stubble cultivations and weed killing. There are, of course, important differences in the standing power of different varieties of cereals, but these differences are not determined wholly by the shortness and stiffness of straw.

The need for caution in the horse-hoeing of early sown root crops, after a certain stage of growth has been reached, has been stressed in these notes on previous occasions. The idea that deep grubbing between root rows is necessarily beneficial to the crop is, however, still widely held, and practised with ill effects. In an experiment with sugar beet, last summer, the yield was in almost inverse ratio to the number of horse-hoeings given. Some soils tend to become capped and crusted, and for that reason may require more hoeing than other soils that have better texture; there is also the question of hoeing necessary to kill weeds; but the value of *deep* horse-hoeing as a means of conserving soil moisture is at least doubtful, and the injury that may be done by cutting through root fibres by injudicious tillage is indisputable.

July is not a time when much seeding is done. Where rape and rotation grass seeds are sown after a half-fallow, good sheep-keep for autumn feeding and a good take of seeds may be obtained by sowing at this time of the year. Some west-country farmers sow a mixture of swedes and thousand-headed kale, which they feed off with ewes and lambs in spring. Considerable areas of common turnips are sown in this month, while land cleared of early potatoes is put down with catch crops for forage or for green manuring. The prevalence of bulb fly in wheat following bare-fallow makes one wonder whether the sowing of mustard on the fallow land in July might not be a means of preventing the trouble; for it is known that the fly lays on bare ground. Possibly the supposed insecticidal effects of a crop of mustard are partly attributable to its covering ground that would otherwise be attractive to the bulb fly for egg laying.

As regards green manuring for the purpose of enriching the soil in humus and increasing the yield of the succeeding crop, it has to be admitted that the results of recent experiments have been most disappointing. Having regard to the well-known apparent benefit of ploughing in turnip tops, grass turf, and other fresh vegetable matter, it is almost inconceivable that a crop of mustard, rape or rye ploughed under should fail to increase the yield of the next crop; but, in the twelve experiments recorded in the *Journal of the R.A.S.E.* for 1926, p. 297, seven showed the effect of the green manure to be that of depressing the yield of the following cereal or potato crop.

Hot Stacks.—In wet seasons the farmer's chief aim in haymaking is to secure the fodder in such a condition that it will afterwards cut up free from mustiness, mould and bitter flavour, which are the results of low-temperature fermentation of damp, dead material. In good seasons this type of "sweating" occurs only when over-made hay has been stacked while damp with dew or other external moisture: the more common problem after fast-drying weather is to prevent high-temperature fermentation. This is due to stacking nutritious herbage before the cell sap has been sufficiently dried and before a certain amount of loss of soluble and fermentable constituents has taken place. The richer and more leafy the herbage, the more likely it is to heat in the stack, but over-ripe fibrous fodder has less fermentable constituents and is more easily dried to a condition of stability.

There is no doubt that from the chemical point of view all heating and sweating is wasteful of nutritive matter. All heat produced in a stack is generated at the expense of food constituents that might have yielded the same quantity of heat, or its equivalent in fat, etc., in the body of an animal. Drying a crop by sweating the moisture out of it is a most extravagant method of haymaking. The direct and indirect losses due to dangerous over-heating and spontaneous combustion, however, are enormous. A recent investigation of the matter in Germany reveals that the annual loss from this cause in that country is about £1,000,000. The greatest number of fires occurred in July and August, but the figures for October and November were high; and fires were more numerous after good than after bad haymaking seasons.

There is still much to be found out regarding the causes of spontaneous combustion in hay stacks, but two methods

are known whereby it is possible to prevent the hay from heating to dangerous temperatures. The first is that of drying the fodder sufficiently before leading it to the rick; the second is that of making the ricks small, circular and placed on raised staddles, so that the heat produced can readily escape. There is less risk of over-heating when the hay has been more gradually cured in cocks than when it has been rapidly dried in swath and windrow and carted direct from the row.

Various suggestions have been made with the object of preventing over-heating of hay that is being stacked in doubtful condition. Observation of the effects of different methods was made in the German investigations mentioned above, and the conclusion was arrived at that the introduction of layers of dry straw and the use of salt were valueless; and the provision of ventilation in the stack was not a certain preventive of over-heating. The treatment recommended was that of spreading the hay as soon as it is observed to have attained an abnormal temperature.

Last year I drew attention to the wisdom of recording the actual temperature of the heart of stacks for some time after stacking, and several correspondents inquired for further particulars of the use of the maximum thermometer recommended. It will therefore be of interest to explain that a fairly rapid rise of temperature to 120° F. need cause no alarm, but the rate of increase should then slow down and 140° F. should not be exceeded, for at this heat the hay begins to turn brown. Should the temperature remain high, the stack should be kept under observation, for the danger of firing may persist for three or four months. There is no doubt that by boring holes down into the centre of the hot stack the escape of excess heat and moisture are facilitated, and if this step is taken in time it should not be necessary to adopt the more drastic measure of spreading the hay, which is itself sometimes attended with the risk of conflagration.

Live Stock.—Sheep management varies considerably in the matter of time in different districts, but in the Midland and Northern counties and with regular breeding flocks of longwools, which lamb in March, both ewes and lambs are dipped in July and the lambs are weaned about the end of the month. The ewes are placed on poor keep and now receive no concentrates, the object being to reduce milk secretion, but the modern shepherd does not consider it necessary to milk

the ewes to relieve the congestion of their udders. The lambs, however, are put on to fairly good grazing but not rich clovery pasture, as this is apt to cause scouring. The chief rules in lamb management at this stage are frequent change of field, avoiding ground recently grazed by older sheep, allowance of ¼ lb. to ½ lb. of concentrated food, cleanliness, and a sharp look-out for maggot fly and husk.

On the best feeding pastures the first lots of bullocks go off fat in July and the fields are allowed to rest and sweeten for a week or two before the second lots are brought in. Apart from the above two cases of change, the management of live stock in July differs little from that in June. Cows in full milk now require some artificial food to maintain their yield and condition on the less abundant grazing. There can be no hard and fast rule regarding the "cake" allowance, but a little liberality may be recommended on the grounds that experiments have shown the benefits of summer-feeding to extend into the winter. Cows that are dry at this time of the year are on some farms very subject to a severe form of mammitis or garget known as "autumn bag." In South Derbyshire the practice of sealing the end of the teat with a special strength of collodion has been found to be a useful preventive measure.

Other ailments of stock that require preventive measures in July are hoven or blown and husk or hoose. Last summer one farmer lost five heifers with hoven, as a result of their having been allowed to eat their fill of damp clover aftermath.

Husk or hoose, when it appears early in July, as it did last year, is frequently not recognised as the parasitic form of the trouble. In this disease early recognition and treatment are of double importance, firstly in the interests of the animals attacked, and secondly to reduce the risk of infecting other cattle.

On farms where husk is troublesome, it may be better not to turn spring-born calves out during their first summer. I have, however, seen cases of husk in calves that have never been out of doors; the calf-house had been occupied during the previous winter by husking cattle, and had not been properly disinfected afterwards. Apart from the prevention of husk, calves out at grass in July should now receive an allowance of concentrated food, otherwise they lose bloom and condition. Small calves, of course, receive little if any benefit from running out on pasture at this season.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending June 15				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½%) ..	13 15	..	13 10	13 12	17 7
„ „ Lime (N. 13%) ..	..	..	..	11 15†	18 1
Sulphate of ammonia :—					
Neutral (N. 20·6%)	12 6*	12 6*	12 6*	12 6*	11 11
Calcium cyanamide (N. 19%) ..	9 16*	9 16*	9 16*	9 16*	10 4
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 15	3 11
Potash salts (Pot. 30%)	4 17	..	..	4 10	3 0
„ (Pot. 20%)	3 12	..	3 9	3 2	3 1
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 0	3 4
Sulphate „ „ (Pot. 48-51½%)	11 10	10 5	10 16	10 17	4 3
Basic Slag (T.P. 32%)	..	..	..	..	..
„ (T.P. 30%)	..	3 2§	3 1§	..	..
„ (T.P. 28%)	..	2 11§	2 10§	..	..
„ (T.P. 26%)	..	2 7§	2 6§	..	..
„ (T.P. 24%)	..	2 2§	..	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10*d*	0 10
Fine grade‖	2 10	..	..	2 7*d*	0 10
Superphosphate (S.P. 35%) ..	3 9	..	3 12	3 2	1 9
„ (S.P. 33%) ..	..	..	3 9	..	..
„ (S.P. 30%) ..	3 2	2 15	3 5	2 17	1 11
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ½%, T.P. 60-65%)	6 0†	6 2†	6 5	5 17	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Hull prices include delivery to any station in Yorkshire, Liverpool to any station in

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

NOTES ON FEEDING STUFFS FOR JULY

E. T. HALNAN, M.A.,
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The Nutritive Value of Feeding Stuffs: A Retrospect.—Since the first issue of these notes, considerable progress has taken place in our knowledge of the feeding of stock, and both the manufacturer and the farmer give more attention to the scientific principles involved in the production and use of purchased feeding stuffs. It may perhaps be claimed that these notes have contributed to this improvement.

In the past, the law has to some extent protected the farmer from the pecuniary loss involved in the purchase of inferior or worthless feeding stuffs by making the manufacturer of compound cakes and meals declare the percentages of albuminoids and oil present in such products, such a declaration enabling the farmer to make a rough and ready estimate of the value of such products as compared with the value of a cake, such as linseed cake, with which he was already familiar. This declaration was all the more essential because a considerable number of the meals and cakes offered to the farmer were compounded from mixtures of cakes or meals which the manufacturer considered it necessary to keep secret, in most cases in order to avoid undue competition from others in the trade. Most of these formulæ were derived from educated and experienced farmers who had found certain mixtures of feeding stuffs to give good results in practice, and the success of the proprietary cakes and meals then offered proved that, in the main, the manufacturers of these products were fulfilling an essential and valuable service to the farming community.

The necessity of secrecy, however, enabled unscrupulous individuals to market products the nutritive value of which was altogether disproportionate to the price charged for them, and tended to throw into discredit even the products of honest manufacturers. This state of affairs was alleviated to some extent, but not entirely, by the provisions of the Fertilizers and Feeding Stuffs Acts. The rapid growth of agricultural education, and particularly the dissemination among farmers by Agricultural Organizers and central institutions, of information on the scientific principles underlying feeding practice, couched in language divested of all scientific technicalities, enabled the farmer to appreciate the real connexion between practice and science, and the better to assign to its true cause any trouble he experienced in the feeding of stock.

With the knowledge thus obtained, the farmer was in a position to compound his own feeding cakes and meals, and the readiness with which he availed himself of this position emphasized the fact that he was no longer content to feed materials in regard to the composition of which he was ignorant. This change of practice impelled the manufacturers of compound cakes and meals to review the situation, and to consider whether a departure from the old attitude of secrecy was not desirable in the interests of business. The writer, some time ago, was informed by a manufacturer of repute that he was obliged to change his methods. "In the past," he stated, "the word of our traveller was sufficient to sell our goods, but now the farmer insists on asking questions about starch equivalents, nutritive value and digestibility, and we have been obliged to take steps to meet this demand." In several instances, manufacturers have taken on their staffs people trained in the scientific principles of feeding to answer all inquiries of this nature received from farmers. In addition to this, the latest results of research are scanned with a view to improving the cakes and meals offered, and, in most cases, the cakes or meals are thoroughly tested out in practice before being offered for sale.

Last, but not least, the manufacturers are now tending to abandon the old idea of secrecy. In America, for some time past, compound cakes and meals of declared content have been placed on the market, and the co-operation of the agricultural advisory staffs invited for the production of suitable feeding stuffs formulæ. That is to say, not only is a full chemical analysis of the cake or meal given, but, in addition, the cakes and meals and the respective proportions present, are also given. This information enables the farmer to appraise very closely the value of the material offered, and also enables him to avoid mixing incompatible materials with it in making up his rations. In England, at least one material of this nature is now being marketed, and the manufacturer will possibly find that his enterprise has been justified by results. A big future for such a policy is assured, since smallholders and small farmers are unable for market reasons to compound their own rations, although they may have the requisite knowledge. It is obvious, however, that such smallholders and farmers will prefer to buy compound cakes and meals of declared content for admixture with their home-grown products rather than to buy cakes or meals the composition of which they do not know. It will also have another

important effect, since the declaration of content will enable agricultural organizers and other advisory staffs to give to inquirers an honest opinion of the value of such products for feeding purposes, an opinion which the present practice of secrecy does not admit.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	10 19
Maize	81	6·8	8 2
Decorticated ground nut cake	73	41·0	11 5
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·55 shillings, and per unit protein equivalent, 1·04 shilling.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 14
Oats	60	7·6	8 1
Barley	71	6·2	9 7
Potatoes	18	0·6	2 7
Swedes	7	0·7	0 19
Mangolds	7	0·4	0 18
Beans	66	20·0	9 9
Good meadow hay	31	4·6	4 4
Good oat straw	17	0·9	2 4
Good clover hay	32	7·0	4 9
Vetch and oat silage	13	1·6	1 15
Barley straw	19	0·7	2 9
Wheat straw	11	0·1	1 8
Bean straw	19	1·7	2 10

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	13 7	0 15	12 12	72	3 6	1·87	9·6
Barley, British feeding	—	—	11 10	0 12	10 18	71	3 1	1·65	6·2
„ Canadian No. 3 Western	41 0	400	11 10	0 12	10 18	71	3 1	1·65	6·2
„ „ No. 4 „	40 0	„	11 3	0 12	10 11	71	3 0	1·61	6·2
„ Persian	36 9	„	10 5	0 12	9 13	71	2 9	1·47	6·2
Oats, English, white	—	—	10 13	0 13	10 0	60	3 4	1·78	7·6
„ „ black and grey	—	—	10 0	0 13	9 7	60	3 1	1·65	7·6
„ Scotch white	—	—	11 10	0 13	10 17	60	3 7	1·92	7·6
„ Canadian feed	23 9	320	8 7‖	0 13	7 14	60	2 7	1·38	7·6
„ American	25 3	„	8 17†	0 13	8 4	60	2 9	1·47	7·6
„ Argentine	28 3	„	9 18	0 13	9 5	60	3 1	1·65	7·6
„ Chilian	29 0	„	10 3	0 13	9 10	60	3 2	1·70	7·6
Maize, Argentine	34 6	480	8 2	0 12	7 10	81	1 10	0·98	6·8
Beans, English winter	—	—	10 10	1 10	9 0	66	2 9	1·47	20
Peas, Japanese	—	—	22 0‖	1 6	20 14	69	6 0	3·21	18
Dari, Egyptian	—	—	11 10	0 14	10 16	74	2 11	1·56	7·2
„ Persian	—	—	10 15	0 14	10 1	74	2 9	1·47	7·2
Millers' offals—									
Bran, British	—	—	7 15	1 6	6 9	42	3 1	1·65	10
„ broad	—	—	8 15	1 6	7 9	42	3 7	1·92	10
Middlings, fine, imported	—	—	10 0	1 1	8 19	69	2 7	1·38	12
„ coarse, British	—	—	9 0	1 1	7 19	58	2 9	1·47	11
Pollards, imported	—	—	8 5	1 6	6 19	60	2 4	1·25	11
Meal, barley	—	—	11 15	0 12	11 3	71	3 2	1·70	6·2
„ maize	—	—	9 7	0 12	8 15	81	2 2	1·16	6·8
„ „ germ	—	—	9 10	0 18	8 12	85	2 0	1·07	10
„ „ gluten feed	—	—	8 15	1 5	7 10	76	2 0	1·07	19
„ locust bean	—	—	8 10	0 11	7 19	71	2 3	1·20	3·6
„ bean	—	—	12 0	1 10	10 10	66	3 2	1·70	20
„ fish	—	—	20 0	4 1	15 19	53	6 0	3·21	48
Maize, cooked flaked	—	—	10 10	0 12	9 18	85	2 4	1·25	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 0	1 16	10 4	74	2 9	1·47	25
„ „ „ 10% „	—	—	11 12	1 16	9 16	74	2 8	1·43	25
„ „ „ 9% „	—	—	11 7	1 16	9 11	74	2 7	1·38	25
Soya bean „ 6% „	—	—	11 5*	2 11	8 14	69	2 6	1·34	36
Cottonseed cake „ 5½%„	—	—	6 10	1 13	4 17	42	2 4	1·25	17
„ „ Egyptian, 5½% „	—	—	6 5	1 13	4 12	42	2 2	1·16	17
Decorticated cottonseed meal, 7% oil	—	—	11 2†	2 11	8 11	74	2 4	1·25	35
Coconut cake, 6% oil	—	—	9 7	1 9	7 18	79	2 0	1·07	16
Ground-nut cake, 7% oil			9 10†	1 14	7 16	57	2 9	1·47	27
Decorticated ground-nut cake, 7% oil	—	—	11 5*	2 12	8 13	73	2 4	1·25	41
Palm kernel cake, 6% oil	—	—	8 10	1 2	7 8	75	2 0	1·07	17
„ „ „ meal, 6% oil	—	—	9 10†	1 2	8 8	75	2 3	1·20	17
„ „ meal 2% oil	—	—	7 17	1 3	6 14	71	1 7	0·85	17
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1·20	2·7
Brewers' grains, Dried ale	—	—	6 17	1 2	5 15	49	2 4	1·25	13
„ „ „ porter	—	—	6 7	1 2	5 5	49	2 2	1·16	13
„ „ Wet ale	—	—	0 16	0 8	0 8	15	0 6	0·27	4·8
„ „ „ porter	—	—	0 11	0 8	0 3	15	0 2	0·09	4·8
Malt culms	—	—	7 10‖	1 12	5 18	43	2 9	1·47	16

Prices at London except where otherwise stated.

* At Hull. † At Bristol. ‖ At Liverpool

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of May and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is £1 2s. per ton. The food value per ton is therefore £8 18s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 12s. 0d.; P_2O_5, 3s. 10d.; K_2O, 3s. 0d.

MISCELLANEOUS NOTES

Agricultural Statistics, 1926-27, Part II

THE Ministry's Annual Report on the prices and supplies of agricultural produce and requirements in 1926-27 was issued last month. This report discusses the movements in prices of the different commodities during 1926, and price changes are compared over a series of years by means of index numbers. The Report shows that, during the cereal year 1925-26, prices of agricultural produce averaged 53 per cent. above 1911-13 or about 5½ per cent. less than in the previous twelve months, while in the seven months, September, 1926, to March, 1927, the index number fell further to 50 per cent. above pre-war. The detailed information as to each of the different forms of agricultural produce shows that most commodities declined in price, but in varying degrees. Prices of feeding stuffs declined from 60 per cent. above pre-war in 1924-25 to only 28 per cent. in 1925-26, and, in the seven months, September, 1926, to March, 1927, were only 27 per cent. above 1911-13. Fertilizers, generally, remained very steady in price and in the last twelve months have averaged only 13 per cent. above pre-war. The Report also contains references to agricultural wages, and the prices of seeds and machinery.

The action taken by the Ministry as a result of the passing of the Markets and Fairs (Weighing of Cattle) Act, 1926, is reviewed in this Report. It is shown that, as compared with two years earlier, the number of markets and marts fitted with auto-dial machines had been increased by nearly 70 by the end of March, 1927, and the number would be further increased when the new machines were fitted in other markets and marts where such machines were on order at that date.

Tables are appended to the Report showing the monthly average prices in 1926 of most agricultural commodities, together with figures of the imports of live stock into Great Britain from Ireland over a series of years, and the imports into the United Kingdom of all the chief classes of agricultural commodities. The quantities imported from each of the chief countries in each of the last five years is also given for wheat, flour, barley, oats, maize, meat, butter, cheese and eggs.

The Report, which forms Part II of the *Agricultural Statistics*, and was issued in previous years as Part III, may be purchased through any bookseller or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1s. 3d. net, or 1s. 4d. post free.

Register of Dairy Cattle

VOLUME X of the Ministry's *Register of Dairy Cattle* was published on June 20, and contains particulars of 7,500 cows selected for their milk performances during the year ended October 1, 1926. The qualification necessary for a cow to be eligible for entry in the Register was that its milk yield was not less than the standard prescribed for its breed or type. The standard yields for the year ended October 1 last were as follows :—

Friesian	10,000 lb.
Ayrshire, Blue Albion, Lincoln Red Shorthorn, Red Poll, and Shorthorn	9,000 lb.
All other breeds or types	8,000 lb.

The cost of producing the Register again necessitated the restriction of the number of entries to 7,500, which is only 48 per cent. of the total number of cows eligible. Of these cows, 25 gave between 8,000 and 9,000 lb. of milk during the year; 472 between 9,000 and 10,000 lb.; 3,127 between 10,000 and 11,000 lb.; 1,924 between 11,000 and 12,000 lb.; 1,008 between 12,000 and 13,000 lb.; 473 between 13,000 and 14,000 lb.; 220 between 14,000 and 15,000 lb.; 227 between 15,000 and 20,000 lb.; and 24 over 20,000 lb. Twenty recognized breeds or types are represented in the volume, 64 per cent. being of the Shorthorn type; 18 per cent. Friesian; and 4 per cent. Guernsey.

The Register also contains a list of 276 cows which have been awarded Certificates of Merit. To be eligible for a Certificate of Merit a cow must have calved not less than three times during a period of three consecutive milk-recording years, and have given, during those years, not less than the prescribed yield of milk, which for the three years ended October 1, 1926, was 30,000 lb. for Friesians and 27,000 lb. for Shorthorns.

Particulars are also given of pedigree bulls of proved milking strain. The condition of entry of a bull in this section of the Register is either (*a*) that its dam and sire's dam must have given the standard yield prescribed for their breed or type during a milk-recording year, or (*b*) that it has two or more daughters which have given not less than the standard yield prescribed for their breed or type in a milk-recording year. Entries relating to 66 bulls are given in the volume, 48 of which qualified under condition (*a*) and 18 under condition (*b*).

The volume contains, also, an up-to-date list of the Milk Recording Societies in England and Wales, with full particulars of each Society and the name and address of the Secretary.

Dairy farmers and others desirous of acquiring pedigree or non-pedigree animals of proved dairy breeding with authenticated milk records should find the Register a valuable book of reference.

The Register is priced 1s., post free, and can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller. A copy of the volume is issued free to all members of Milk Recording Societies.

* * * * * *

Display of Empire Produce at Belfast

AN account of the Empire Shopping Week held at Belfast from 23rd-28th May was given in the JOURNAL for June, p. 193. The lower photograph opposite gives a general view of one side of the Ulster Hall, the Great Britain section occupying the three centre bays on that side. The top photograph shows the display of home produce in greater detail. The centre portion comprised fruit products; on the left-hand side were bacon, hams, packed meats and dairy produce; on the right-hand side were cereal products and various other packed foodstuffs, and in the foreground around the pillars, hothouse tomatoes, cucumbers and mushrooms were effectively displayed. Altogether about 50 firms contributed to this stand, which was greatly appreciated by the many visitors to the exhibition.

There is a danger that an effort of this kind may become merely a "nine days' wonder." It is understood that a certain amount of new business in home products has already eventuated as a direct result of the display, and it is for producers and manufacturers in this country to follow up the advantage gained in order to ensure that the effort is permanent.

* * * * * *

The Agricultural Index Number

PRICES of agricultural produce during May were on the average 42 per cent. above those in the corresponding month of the years 1911–13, as compared with 43 per cent. in April and 50 per cent. a year ago. The reduction in the general index number in May resulted from the drop in the average contract price of milk in the Manchester area and the continuance of the decline in fat pig prices. Grain and potatoes on the other hand increased in price, following upon a period of about five months during which little change in values had occurred.

Detail view of the Great Britain Section.

General view of the Display of Empire Produce, Ulster Hall, Belfast.

To face page 380.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	—
July	67	50	53	49	48	—
August..	68	52	57	54	49	—
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.—Wheat prices after falling slightly during March and April rose in May to 12s. 1d. per cwt., an increase of 7d. per cwt. on the month. The rise, however, was practically proportionate to the increase in May of the base years 1911–13, and the index number was only one point higher at 53 per cent. above pre-war. An increase of 4d. per cwt. in the price of barley brought the relative index figure to 46 per cent. above the level of the base years, a rise of 5 points on the month, while oats were 1s. 1d. per cwt. dearer than in April, the index figure rising by 9 points to 27 per cent. more than pre-war rates.

Live Stock.—The average prices obtained for fat cattle in May varied little from those realized in April, and store cattle practically maintained the values ruling in the previous month, the index figures for fat and store cattle standing at only 24 per cent. and 23 per cent. above pre-war respectively. Dairy cows, however, showed a decline of about 8s. per head. There was the customary spring fall in fat sheep prices and the index figure remained unaltered at 53 per cent. above pre-war, but there was a small decrease of 2 points in the index figure for store sheep. Bacon pigs declined by 4d. and porkers by 8d. per 14 lb. stone, the average prices being 58 per cent. and 66 per cent. respectively above pre-war. Prices of fat pigs have now declined to about the same level as at the end of August, 1925. Store pigs also show a fall in price, but although cheaper than in recent months they are still making about double pre-war rates.

Dairy and Poultry Produce.—Egg prices averaged the same as in April, but the rise in May in the base years caused a

decline of 9 points in the index number to 28 per cent. above pre-war. Butter was reduced about 2d. per lb., although as a proportionate reduction occurred in the base years there was little alteration in the index number; but cheese, contrary to the usual movement at this season, was a little dearer and the index number rose 10 points to a level of 46 per cent. above 1911–13. The reduction to 10d. per gallon in the average price of milk delivered under contract in the Manchester area affected the index number of this commodity to the extent of a fall from 63 per cent. above pre-war in April to 53 per cent. in May.

Other Commodities.—Vegetables were about 26 per cent. dearer than in May, 1911–13, as compared with 19 per cent. in April, and hay was a trifle higher in price and index number. A rise of about 10s. per ton in the price of potatoes occurred during May after a period of comparatively steady trade, and the index figure appreciated considerably to 74 per cent. above pre-war, the corresponding figure a year ago being only 15 per cent. Wool prices declined slightly in May to 31 per cent. dearer than 1911–13.

Index numbers of different commodities during recent months and in May, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	May	May	Feb.	Mar.	Apr.	May
Wheat	59	67	60	57	52	53
Barley	36	22	37	38	41	46
Oats	36	30	16	14	18	27
Fat cattle	49	43	30	26	25	24
Fat sheep	100	67	44	45	53	53
Bacon pigs	60	88	63	63	61	58
Pork pigs	60	90	75	76	73	66
Dairy cows	48	36	26	25	26	24
Store cattle	40	29	30	27	23	23
Store sheep	99	55	48	41	40	38
Store pigs	55	122	125	116	108	99
Eggs	48	38	62	39	37	28
Poultry	55	61	39	34	25	41
Milk	55	60	62	56	63	53
Butter	54	52	40	40	43	42
Cheese	70	83	36	36	36	46
Potatoes	124	15	94	85	60	74
Hay	3	9	- 2*	—	- 1*	2
Wool	50	29	32	33	34	31

* Decrease.

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on May 23 and June 14, at 7 Whitehall Place, S.W. 1, the Chairman, Lord Kenyon, presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying out the Committees' decisions:—

Bedfordshire and Huntingdonshire.—An Order, to come into operation on May 30, continuing, until further notice, the existing minimum and overtime rates, but providing that all employment on Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day should rank as overtime employment and be paid for at the overtime rate applicable to Sunday work. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of 48 hours in winter and 50 hours in summer, and overtime at 9d. per hour on weekdays and 11d. per hour on Sundays and on the six public holidays mentioned above. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for all time worked.

Hampshire and Isle of Wight.—An Order fixing special differential rates of wages for overtime employment of male workers on the corn harvest in 1927, the rate in the case of workers of 21 years of age and over being 9d. per hour.

Hertfordshire.—An Order, to come into operation on June 18, fixing special differential rates of wages for overtime employment of male and female workers on the hay harvest in 1927, the rate in the case of male workers of 21 years of age and over being 10d. per hour, and for female workers of 19 years of age and over 7½d. per hour.

Norfolk.—(1) An Order continuing, from June 2 until December 31, 1927, the operation of the existing minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 50 hours in summer and 48 hours in winter, with, in addition in the case of teamsmen, cowmen, shepherds or yardmen, 5s. 6d. per week, and, in the case of sheep-tenders and bullock-tenders, 4s. 6d. per week in respect of employment in connexion with duties of feeding, cleaning, milking, bedding down or mucking out stock, or for similar duties in connexion with the immediate care of animals. The overtime rates for all classes of male workers are 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

(2) An Order fixing special minimum and overtime rates of wages for employment of male workers on the corn harvest in 1927. In the case of workers of 21 years of age and over who are employed throughout the full period of the harvest a sum of £11 is payable in respect of the harvest month, whilst in the case of workers of the same age who are not employed throughout the whole period payment must be made at the ordinary minimum rate, with overtime at 9½d. per hour.

North Riding of Yorkshire.—An Order varying, as from June 20, 1927, the existing minimum and overtime rates of wages for male and female workers, which will continue in operation until further notice. The rates fixed in the case of male workers of 21 years of age and over are 33s. per week of 48 hours in winter and 52½ hours in summer, with special hourly rates, in certain cases, for workers who are required to perform work on the care of and attendance

upon animals, the rates being 3d. per hour for workers who are boarded and lodged by their employer and 6d. per hour for workers who are not so boarded and lodged (instead of 4d. and 8d. per hour respectively as at present). The overtime rates for male workers of 21 years and over are 10d. per hour on weekdays and 1s. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for a week of 44 hours, with overtime at 9d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Special Minimum Rates of Wages for the Hay Harvest.—Further to the note, in the June issue of this JOURNAL, as to hay harvest rates, the Hertfordshire Agricultural Wages Committee have now fixed special overtime rates for male and female workers employed on the hay harvest, the rates in the case of male workers of 21 years of age and over being 10d. per hour, and for female workers of 19 years of age and over 7½d. an hour.

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Special Minimum Rates of Wages for the Corn Harvest.—Special rates of wages for employment on the corn harvest in 1927 have been fixed by eight Agricultural Wages Committees, *viz.*, Derbyshire, Devonshire, Dorsetshire, Hampshire and Isle of Wight, Norfolk, Somersetshire, Wiltshire, and the East Riding of Yorkshire. In each case similar rates were fixed last year. In the cases of Cambridgeshire and Isle of Ely, Essex, Hertfordshire, and Suffolk, where special rates were fixed last year, no proposals in regard to corn harvest rates have yet been issued, but meetings of these Committees have been arranged to discuss such rates.

The rates fixed apply only to male workers except in the case of the East Riding of Yorkshire, where provision is made for female workers also. Except in the case of Norfolk, the special harvest rates apply only to overtime employment, the harvest overtime rate for adult male workers being 9d. per hour in the case of Derbyshire, Hampshire and Isle of Wight, and Wiltshire, and 10d. per hour for Devonshire, Dorsetshire, and Somersetshire. The special overtime rates for the East Riding of Yorkshire are in the case of male workers of 21 years of age and over who are not boarded and lodged by their employer 1s. 3d. per hour, and in the case of male workers who are boarded and lodged by their employer, and who are engaged to perform duties usually assigned to foremen, beastmen, shepherds and waggoners, 1s. per hour. In the case of female workers of 16 years of age and over, in that area, the special overtime rate is 11d. per hour. With regard to Norfolk, special minimum and overtime rates of wages have been fixed, and in the case of adult male workers who are employed throughout the full period of the harvest an inclusive sum of £11 is payable in respect of the harvest month. Where workers of the same age are not employed throughout the whole period, payment must be made at the ordinary minimum rate, with overtime at 9½d. per hour.

Lesser rates are fixed for younger workers in all the areas concerned.

Copies of the Orders in full may be obtained free of charge on application to the Secretary of the Agricultural Wages Board, 7 Whitehall Place, London, S.W. 1.

In the areas where the Agricultural Wages Committees have not fixed any special rates for the corn harvest employment on such work must, of course, be paid for at not less than the ordinary minimum and overtime rates.

Enforcement of Minimum Rates of Wages.—During the month ending June 15, legal proceedings were instituted against five employers for failure to pay the minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines	Costs	Arrears of wages	Workers concerned
		£ s. d.	£ s. d.	£ s. d.	
Sussex ..	Petworth ..	3 0 0	2 2 0	34 4 8	2
„ ..	„ ..	—	—	49 18 3	3
Kesteven .	Bourne ..	0 5 0	—	26 5 0	1
Carms ..	Whitland ..	—	—	12 0 0	1
Devon ..	Lifton ..	2 0 0	—	15 0 0	1
		£5 5 0	£2 2 0	£137 7 11	8

In the case heard at Lifton, the Chairman of the Bench said that, as this was the second case before the Court, he wished the Press to emphasize the fact that farmers must adhere to the provisions of the Act and the Orders made by the Committee. As the Orders had been in force some considerable time, there was no excuse for any employer not knowing the provisions thereof.

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Importation of Raw Cherries from France : Prohibition Order.—In last month's (June) issue of this JOURNAL (p. 279) a recapitulation was given of the reasons which led the Ministry to issue an Importation of Raw Cherries Order in June, 1926, the provisions of which were briefly noted in this JOURNAL for July of that year (p. 293). Particulars were also given of the arrangements made subsequent to that Order by the French Government, which it was hoped would effectually prevent the export to this country of French cherries infested with cherry fruit fly. In view of these arrangements, the Order of 1926 was replaced by the Importation of Raw Cherries Order, 1927, details of which were given in the note referred to. The examination, however, of samples from consignments of French cherries, taken by the Ministry's Inspectors on the markets last month, revealed the presence of some heavy infestations by the maggot of the cherry fruit fly ; and, in answer to a question by Sir G. Wheler in the House of Commons on June 16, 1927, the Minister stated that he had decided, in consequence, that the importation of cherries grown in France must be stopped for the remainder of the season. This action was necessary to avoid the risk of the establishment of the pest in British cherry orchards. An Order giving effect to this decision came into operation on June 24.

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Foot-and-Mouth Disease.—The country continues free from outbreaks of foot-and-mouth disease, no case having been confirmed since that at Ellel, Lancashire, on April 6 last.

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Glassware Used in Dairy Chemistry.—The National Physical Laboratory, Teddington, have issued a new edition, dated April, 1927, of their pamphlet, *Tests on Volumetric Glassware used in Dairy Chemistry*. This contains the regulations for Class B tests on such glassware submitted to the Laboratory for testing and marking. The pamphlet sets out the construction and marking required for the following : Gerber butyrometer for milk testing ; Gerber butyrometer for cream testing ; Gerber butyrometer for cheese testing (van Gulik type) ;

Babcock milk test bottle; Babcock cream test bottle; Leffmann-Beam milk test bottle; milk pipettes, cream pipettes, etc. Drawings of the apparatus and the charges for testing are also given.

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International Competition for Machines to Cut Reeds, Rushes, etc.—L'Union des Syndicats de l'Etang, a Parisian Society, is organizing, from July 19 to 26, 1927, in the neighbourhood of the French capital, an international competition for mowing machines and apparatus specially adapted for destroying vegetation, reeds, rushes, etc., obstructing rivers, canals, ponds and watercourses. Particulars of the competition may be obtained on application to the representative of the Union at 1, rue de Castiglione, Paris.

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NOTICES OF BOOKS

Composition and Distribution of the Protozoan Fauna of the Soil. By H. Sandon, M.A. (Edinburgh: Oliver and Boyd. 1927. 237 pp., 6 pl. Price 15s. net.)

Although agriculture is among the oldest of the arts practised by man it has been slow in enlisting the aid of the sciences, and has preferred to act on a system based on experience and empiricism. In recent years, however, the tendency has been to appeal more and more to the scientist for counsel and aid, and a place has been found for almost all the special sciences. The latest recruit is a new branch of a new subject, namely that of Protozoology, that is the study of protozoa, the smallest and most primitive types of animal life, which bear the same relation to the animal kingdom as do bacteria to the vegetable creation, and the new branch is the study of those protozoa which inhabit soils.

Serious interest in these organisms only dates from 1909, when Russell and Hutchinson published their theory of partial sterilization of the soil, which was based on the action of protozoa as devourers of bacteria. Since that time the progress of knowledge of these forms has not advanced so much as one would wish, but the difficulties are very great for many reasons, of which the chief is perhaps the great diversity of varieties which occur. Even if the varieties were few or very simple, however, the problem would be no easy one because of the number and extent of the other variables such as weather conditions, cultivation procedures, or type of vegetation; while no agriculturist needs to be reminded of the great differences which exist between different samples of soils. A soil from one area may vary considerably in its physical, and indeed in its chemical, condition from time to time throughout the year, becoming more or less acid, or containing more or less nitrogen. These factors in themselves are apparently of little direct importance, but by exerting an influence on the available food supply, which is in most cases composed of the bacterial flora, they control the numbers, and perhaps also the species, of the protozoa present.

In adding the volume mentioned above to their series of Biological Monographs and Manuals, the editors, Drs. F. A. E. Crew and D. Ward Cutler, have filled an obvious space in the literature of this growing subject, and in Mr. H. Sandon they have found an excellent exponent. The book deals shortly with the influences affecting the numbers and distribution of the various species of protozoa in the soil—of which some 250 species have already been recorded—and with the soil protozoal community, and then devotes the major portion

to a systematic account of the protozoa found in the soil, giving keys to their identification. This is perhaps the most valuable part of the work, since no proper agreement can be reached by different investigators unless there is some standard by which they may be certain of the species under examination, and avoid overlapping of descriptions under various names. Six excellent plates, figuring from eleven to twenty-five protozoa each, amplify the descriptions, and three folder charts give the geographical distribution of the three classes of Mastigophora, Rhizophora, and Ciliata. A bibliography of over 120 references completes the volume. One can justly say that the book is a necessity for all workers on the micro-organisms of the soil, and it has the added advantage of being pleasant to handle and read, for the format and fount are very well chosen.

The Individuality of the Pig. By Robert Morrison. (London: John Murray. 1926. Price 7s. 6d. net.)

In this book, which is really a comprehensive treatise on pig husbandry, the author has succeeded in combining, in a most readable form, the practical and scientific aspects of breeding, feeding, rearing, and management—the whole happily seasoned with an intuitive understanding of the qualities and characteristics that constitute individuality. Such knowledge is derived from daily contact with animals and close study of their idiosyncracies.

The appearance of this book, at a time when farmers are looking hopefully to pigs as a means of succour in their troubles, is most opportune. For a beginner, the book is eminently suitable, and even the experienced pig-keeper may learn much from it. The beginner wants to know what breed he should keep and how many head; whether his stock should be pedigree, pure-bred or cross; whether to buy weaners, gilts ready for service, or gilts in pig; whether to breed for sale as weaners, or for pork or bacon; and how to house—whether in sties or in shelters with free range, or partly one and partly the other. To all these questions and many more he will find reasoned and convincing answers.

The principles of feeding, and the characteristics of the commoner feeding stuffs, are also fully dealt with, and tables of analysis are given. Mixtures of different composition are rightly recommended for different ages and classes of stock; but the deliberate omission of itemized examples of what the author would consider suitable rations may be misconstrued. The omission is particularly noticeable in the light of the author's final observation to the effect that he will make arrangements with local millers "to buy, grind and mix the various mixtures for your supply at fair market prices, provided that among you and your friends in any one district or county a minimum guarantee be given that one hundred tons (100 tons) of meals per annum will be ordered and paid for through that miller."

The Cattle-Breeder's Handbook. By James A. Scott Watson, B.Sc., James Cameron and G. H. Garrad, N.D.A. *Farmer and Stock-breeder* Manuals. (London: Ernest Benn, Ltd. 1926. Price 6s. net.)

This book aims at placing before farmers the results of scientific thought and research in matters relating to the breeding, rearing and feeding of cattle for beef and milk. It opens with a description and discussion of the beef, dairy and dual purpose types of animal, the treatment of this aspect being characterized by acute observation and sound reasoning. Regarding dual purpose cattle, the authors point out that the feeding has a marked influence on conformation, and that an animal can often be so developed as to show a considerable

measure of beef or milk conformation at the will of the rearer; further, that "the sharp wither, lean thighs, capacious barrel and general thinness of flesh," characteristic of the dairy type, is, to a large extent, the consequence and not the cause of heavy milk production. From which it follows that the antagonism between beef points and milk production is not so fundamental as has been commonly supposed. Systematic breeding on dual purpose lines is comparatively recent, and long-continued selection is necessary to ensure fixity of type. But the dual purpose animal is not ruled out, either genetically or economically; indeed, so long as sterility and abortion are prevalent, and the period of a cow's usefulness is, in consequence, only a matter of a few years, the practical breeder may be on safe ground in ignoring, to some extent, purely theoretical considerations.

The vexed question of "breed characteristics" also comes under critical examination, and the authors plead for a strict sense of proportion in regard to the various objects in view, so that the more important may not be sacrificed for the less important ones. They point out, rightly, that the recognized standard of non-economic characters, such as colour, horns and so forth, should be fixed as permanently as possible, so as to avoid waste of effort on the part of the breeder in endeavouring to keep his herd "in the fashion." Farmers and students, alike, will welcome this clear and simple exposition of the principles of breeding, as set out by acknowledged authorities on the subject. Altogether, a readable and useful publication.

The Evolution of the English Farm. By M. E. Seebohm, F.R.Hist.S. (London: George Allen & Unwin, Ltd. 1927. Price 16s. net.)

As a popular introduction to the history of English farming, this book is likely to find a wide public. Efforts of the kind are usually more ambitious in the planning than in their fulfilment, and this work is no exception to the rule. For any one person to attempt the history of some sixty centuries in the small space of 364 pages obviously leads to considerable spareness of detail, if not throughout the work, then at constantly recurring intervals. Such an attempt is nevertheless worthy of commendation, if it presents as one coherent story the results of modern detailed investigations into special questions or comparatively brief periods. It is a little unfortunate, however, that in this instance the story is not told quite so coherently as might be wished.

It traces the progress of agriculture in England from the Stone Age to the twentieth century. Much of the earlier part could be subjected to the obvious criticism of all such work. The con lusions of the archæologists are accepted with little examination, imaginative though they frequently are. A particular example of this acceptance of authority is the comparison of the so-called oak hand-plough found in the Glastonbury lake village with the *caschrom*, which was used up till the nineteenth century in the Western Highlands: but that the Glastonbury piece of oak was a plough or an agricultural instrument of any sort is just a guess and nothing more. So far as we know the English breast-plough—not very dissimilar to the *caschrom*—was a comparatively modern invention, and no reference to it in the Middle Ages has been found.

All the early history of the English farm, until the Norman Conquest, is covered in the first five chapters, and is largely based upon secondary authorities. The next three chapters deal with the period from the Norman Conquest to the end of the fifteenth century, and again we find the acceptance of other people's conclusions without a sufficient examination of the original evidence or reference to the most recent work on the subjects treated. In particular the Black Death is regarded

as catastrophic, although the general trend of modern investigation is to show that the conventional view of the effects of the plague is exaggerated. Nor is there a scrap of evidence for the statement that "the great underlying cause of the breakdown of the manorial system was the increasing exhaustion of the soil": since the land had been continuously cropped as far back as the Roman period and before, it would have been remarkable if the soil had suddenly shown signs of exhaustion in the fourteenth or fifteenth century. But the writer is not a biologist and seems to have had no guidance from anyone with biological knowledge: otherwise not only her treatment of soil fertility, but her attempt to trace the history of live stock would have been different. From the sixteenth century onwards, we begin the modern phase of English agriculture, and it is easier to tell a story without danger of distorting the facts: but there are many contemporary authorities which the author might have consulted, but has somehow missed. She might, however, reasonably retort that one cannot read everything, that the task of sifting the grain from a vast deal of chaff was not worth while for an elementary treatise and that she has not given bad measure.

The chief merit of the book is that it reads easily and, for those who have neither the time nor the inclination to study special monographs, it will be instructive. It is unfortunate that so many statements need qualification which the uninstructed reader will not be able to supply. Perhaps one day the book will be rewritten in the light of fuller knowledge.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Seebohm, M. E.—The Evolution of the English Farm. (376 pp. + 3 pl.) London: George Allen & Unwin, 1927, 16s. [63 (09); 63.17 (09).]

Gras, N. S. B.—A History of Agriculture in Europe and America. (444 pp.) London: Pitman & Son, 15s. [63 (09).]

Clapham, J. H.—An Economic History of Modern Britain. The Early Railway Age, 1820-1850. (623 pp.) Cambridge: at the University Press, 1926, 25s. [33.338 (42).]

Webb, S. and B.—English Local Government: English Poor Law History, Part I. The Old Poor Law. (447 pp.) London: Longmans, Green & Co., 1927, 21s. [336.28; 362.5.]

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Maine Agricultural Experiment Station.—Bulletin No. 322: Fertilization of Apple Orchards in Maine. (8 pp. + 1 pl.) Orono, 1925. [63.41-16.]

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Live Stock and Feeding Stuffs

Darley, Matheson.—The Horse in Health, Accident, and Disease (235 pp.) London: C. A. Pearson, 1921, 5s. [63.61; 619.1; 682.]

Hawkesworth, A.—Australasian Sheep and Wool: A Practical and Theoretical Treatise. (Fifth Edition.) (594 pp.) Sydney: William Brooks & Co., 1920. [63.6 (9); 63.631; 63.761.]

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The Small Landowner, 1780-1832, in the Light of the Land Tax Assessment. *E. Davies*. (Econ. Hist. Rev., I, 1 (Jan., 1927), pp. 87-113.) [336.22; 333.5.]

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Agricultural Research in the British Empire: IV.—Agricultural Research in Australia. *F. L. M'Dougall* and *A. S. Fitzpatrick*. (Scottish Jour. Agric., X, 2 (April, 1927), pp. 171-180.) [37 (9).]

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The Organization of German Agriculture (Translated). *Axel Schindler*. (Scottish Jour. Agric., X, 2 (April, 1927), pp. 144-155.) [63 (43).]

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The Agricultural Co-operative Movement in Esthonia. (Int. Rev. Agr., I, 1 (Feb., 1927), pp. 2-12.) [334 (4).]

Some Effects of Phosphatic Manures and Ground Lime on Acid Pastures. *A. W. Ling*. (Jour. Bath and West and S. Counties Society, I (Sixth Series), 1926-27, pp. 49-78.) [63.33-15; 63.33-16.]

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The British Beet Sugar Industry. *G. Turville Brown.* (Paper read at General Meeting of Surveyors' Institution, April 11, 1927.) (Trans. Surveyors' Inst., LIX (1926-27), 5.) [63.3433 (42); 664.1.]

Rural Electrification in Sweden. *A. Ekstrom.* (Jour. Farmers' Club, 1927, Part 4 (May), pp. 61-84.) [537.]

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Pest Destruction by Aeroplane. Note by *A. E. Blake.* (Sci. Prog., XXI, 84 (April, 1927), pp. 688-691.) [63.294.]

Crane Fly Grub and the Oat Crop. *J. Rennie.* (Scottish Jour. Agric., X, 2 (April, 1927), pp. 184-195+1 pl.) [63.27.]

Insect Control of Noxious Weeds. Joint Scheme initiated against Blackberry and other species. (N.Z. Jour. Agric., XXXIV, 2 (Feb., 1927), pp. 84-90.) [63.259; 63.296.]

Live Stock

The Development of the Animal for Meat. *J. Hammond.* (Jour. Bath and West and S. Counties Society, I (Sixth Ser.), 1926-27, pp. 11-21+3 pl.) [63.60; 63.6043; 63.75.]

English Bacon and the Supply of Pigs. *Viscount Folkestone.* (Jour. Bath and West and S. Counties Society, I (Sixth Series), 1926-27, pp. 37-49.) [63.64; 63.752.]

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Certain Aspects of Milking Trials. *S. Bartlett.* (Jour. Brit. Dairy Farmers' Assn., XXXIX (1927), pp. 59-68.) [63.711; 63.712.]

Variations in the Proportion of Solids-not-Fat in Milk. *J. F. Tocher.* (Scottish Jour. Agric., X, 2 (April, 1927), pp. 201-208.) [543.2; 63.712.]

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Economics

Farm Valuations. *R. Cobb.* (Jour. Farmers' Club, 1927, Part 3 (April), pp. 41-59.) [63.191.]

The Present Position of Arable Land with regard to Labour Costs, Direct and Indirect. *J. Wyllie.* (Jour. Farmers' Club, 1927, Part 2 (March), pp. 21-40.) [331 (42); 338.58.]

The McNary-Haugen Plan as applied to Wheat Operating Problems and Economic Consequences. (Wheat Studies, III, 4 (Feb., 1927), pp. 177-234.) [63.311:31; 63.311:38.]

The Co-operative Marketing Association as a Factor in Adjusting Production to Demand. *H. E. Erdman.* (Jour. Farm Econ., IX, 1 (Jan., 1927), pp. 73-81.) [334.6; 338.1.]

Some Long-Time Effects of Co-operative Marketing. *R. S. Vaile.* (Jour. Farm Econ., IX, 1 (Jan., 1927), pp. 82-93.) [334.6.]

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NOTES FOR THE MONTH

Imperial Agricultural Research Conference

An Imperial Agricultural Research Conference will be held in London in October next, and will be attended by some 70 delegates of high administrative and scientific standing from the oversea parts of the Empire, together with delegates and representatives of similar standing from Great Britain and Northern Ireland. The Conference will discuss subjects of great importance, for agricultural research affects everyone very closely. It is probable that but for the results that scientific workers have achieved in recent years, milk, butter, meat, fruit and vegetables would all cost more and be poorer in quality. Speaking generally, agricultural research has led to the production of larger and more quickly maturing cattle for the purpose of meat, cows with heavier milk yields, and wheats that produce a far more abundant harvest of choice flour, than were known to farmers two or three generations ago. It might, indeed, be interesting to speculate how our vast city populations could be fed to-day if agriculture had stood still after the industrial revolution of the eighteenth and nineteenth centuries. Thanks, however, to the patient skill and infinite ingenuity of research workers, agriculture has made great strides in all branches; but innumerable questions of the utmost practical importance still remain unsolved.

This holds true throughout the world and for each department of agriculture, but it applies with special force when we consider our own Empire. The lands within the Empire lie in many different latitudes, and thus present a great variety of agricultural problems. Many parts of the Empire are only on the threshold of development, and those who are engaged in adding to and improving the areas under cultivation are in constant need of scientific advice and assistance.

One successful experiment may conceivably extend the wheat-growing belt of Canada a hundred miles to the north,

thus bringing thousands of virgin acres to the service of food production; another may lead to the destruction of an insect pest that is ruining a cotton area, and incidentally occasioning great damage to our textile industry; and just as immunization against cattle plague enabled stock raising to be successfully carried on over large tracts of South Africa, so research now in progress may result in preventing foot-and-mouth disease, thus saving the large sums which that disease has, periodically, cost this country. These are but random examples of the benefits that may accrue to Imperial agriculture from scientific research. Yet, it may be observed, the sum devoted to agricultural research in the whole Empire is less than half the amount that is spent in the United States of America.

It is not often that sudden spectacular results are achieved, and, indeed, they are hardly to be looked for; but steady and valuable progress is being recorded, and it is of real importance that those who are engaged in this vitally significant work should be kept in touch with one another. This is an Empire need.

There are, at present, research stations in this country and in the Dominions and Colonies, very largely financed by their respective Governments, which are doing invaluable service. Much of the work being done by the research workers at these stations is of interest to the Empire as a whole. Although some links do exist between them, the system of intercommunication is far from adequate, and it is hoped that the Conference may be able to devise methods to secure the closest co-operation between the scientific workers in agriculture throughout the Empire.

The chief subjects to be discussed at the Conference will be the extension of the system of Imperial Bureaux from entomology and mycology to other departments of agricultural science; the interchange of information among agricultural research workers; the recruitment, training and interchange of workers; and the development of the chain of agricultural research stations throughout the Empire. The main meetings of the Conference will be held in London, Cambridge and Edinburgh.

The Empire Marketing Board has made a grant to cover the expenses of the Conference, for which the arrangements are being made by the Ministry and a representative Organizing Committee.

Guide to Official Statistics

PERHAPS one of the most striking of post-war developments has been the increasing recognition of the importance of statistics in all branches of activity, in the organization and management of commercial and industrial enterprises as well as in the investigation of social and economic problems. Government publications are the most important of all sources of statistics in the United Kingdom from the point of view both of their scope and of their authority. The complaint used to be, however, that this valuable material was unknown and inaccessible except to the few who had specialized in the study of official publications.

The introduction of the *Annual Guide to Current Official Statistics*, the 1926 volume of which has just been issued by the Permanent Consultative Committee on Official Statistics, has removed all difficulties that may in the past have stood in the way of those who wished to avail themselves of this indispensable source of information.

The Guide is much more than a mere catalogue of publications. Its central feature is an index on novel lines, which not only directs the inquirer to those volumes which contain statistics bearing on his subject, but also indicates their scope and degree of detail. To trace all the statistics on the varied subjects dealt with in Government publications is a matter of a few minutes with the aid of the Guide, which should prove a handy work of reference for the business man, writer, librarian, student of public or social matters, and professional worker. Copies of the Guide can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 1s. net, post free 1s. 4d., or through any bookseller.

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Empire Displays: Participation of Home Produce

Advertising Exhibition.—Arrangements in connexion with the Advertising Exhibition held at Olympia were well advanced early in July. The Empire Marketing Board took 10,000 square feet of space, and adopted a design which proved both novel and striking. A good proportion of the space devoted to the display of produce from home and overseas was allotted to Great Britain. The Ministry, in collaboration with the National Farmers' Union, the Food Manufacturers' Federation, the National Food Canning Council, the National Association of Cyder Makers, the British Glasshouse Produce Marketing Association, and the Western

Curers' Association, organized a representative display of bacon, hams and packed meats, eggs, dairy produce, fresh fruit and vegetables, tinned and bottled fruit and vegetables, cereal products and glasshouse produce. On the outer sides of the Empire Marketing Board stand there were a number of decorative windows, seven of which were dressed exclusively with home produce. There were also two demonstration kitchens, in which full use of home products was made. One kitchen was secured exclusively for home products on each evening of the week. By courtesy of the management, the chef of the First Avenue Hotel demonstrated, on three evenings, some of the multitudinous ways of cooking potatoes, and the National Milk Publicity Council arranged for milk-cooking demonstrations on the other evenings.

A new feature was an exhibition of labels and containers. The appearance and clarity of a label plays an important part in selling the product, and it is, therefore, desirable for Empire producers to pay due attention to this aspect of salesmanship. A varied collection of labels was made and a representative committee selected the best specimens for display. In addition, a number of specially-designed labels were exhibited; these were offered for sale under certain conditions. This section of the Empire Marketing Board stand proved of considerable interest, and, apart from the merits of the labels shown, an appreciable amount of advertisement should result for the goods represented. Efforts were accordingly being made to secure as good a show for home products as possible among the labelled goods.

London Display Week.—An Empire Shopping Week was organized under the ægis of the Advertising Club, to synchronize with the Advertising Exhibition. About 60 London boroughs and districts participated in the scheme, which proved to be a great success. The Ministry was represented on the several committees which dealt with the matter, and, by this means, was able to keep home producers informed of the various proposals afoot. The editors of London and suburban newspapers having promised generous allocation of space in connexion with the Display Week, the Ministry secured articles from the National Farmers' Union and other sources, or had articles prepared which drew attention in various ways to the excellence of home-grown produce, and formed a useful background for the slogan that "Empire buying begins at home."

Edinburgh Exhibition.—An Empire Exhibition is being held at the Waverley Market, Edinburgh, from July 27 to August 6. The Empire Marketing Board is staging a small display on this occasion, and the usual arrangements have been made by the Ministry for the participation of home produce.

* * * * * *

Notes on Feeding Stuffs

SOME five years ago, Mr. E. T. Halnan, of the Animal Nutrition Institute, Cambridge University, began to contribute monthly "Notes on Feeding Stuffs" to the pages of this JOURNAL. Lately, Mr. Halnan expressed a desire to hand over this work to a new contributor; and, in meeting his wishes, the Ministry desires to record its cordial appreciation of the extended and able service rendered by him.

The Ministry is glad to announce that Dr. H. E. Woodman, of the same Institute, has undertaken to furnish the "Notes on Feeding Stuffs" during the next twelve months, and his first contribution, which takes the form of a very explicit statement of the principles underlying the subject of feeding stuffs, will be found on p. 473 of this issue.

* * * * * *

Farm Live Stock Judging Competition

A COMPETITION in the judging of live stock, open to students of Farm Institutes in England and Wales, was held on May 26 last, on the farm of Messrs. W. C. and A. J. Flowers, at Beachendon, Aylesbury, Bucks. The educational possibilities of stock judging contests have been clearly demonstrated, and it was thought that the end in view would be greatly helped by the institution of an annual stock judging competition, open to teams of students from Farm Institutes.

In response, therefore, to a suggestion made by the Ministry, the National Farmers' Union agreed to offer a perpetual Challenge Cup for such a competition. The administration of the competition was entrusted to a committee representative of the National Farmers' Union, the Royal Agricultural Society of England, the County Councils' Association and the Ministry, and it was arranged that the Ministry should appoint the judges. The competition held this year was the first event of the kind and it was carried through successfully in every way under the direction of Mr. P. J. Bradshaw, County Secretary of the National Farmers' Union, and a number of stewards. The classes of stock selected for the competition comprised

Dairy Shorthorn Heifers, Dairy Shorthorn Cows, Shire Horses, Cross-bred Pigs, Border-Leicester and Cheviot Ewes, and Light Sussex Poultry. The animals and birds were judged by experts before the competition started and their decisions served as the standards for arriving at the final results.

Six Institutes sent teams: the East Anglian, Hampshire, Llysfasi (Wales), Northamptonshire, Staffordshire, and East Sussex. Each team consisted of three students, and all did well. The Challenge Cup was won by the Northamptonshire team, the Staffordshire team being second, and the Welsh team third. Mr. T. W. Baxter, the President of the National Farmers' Union, attended and presented the Cup to the winning team.

A useful feature of the competition was the presence, from outside farms, of noted specimens of Dairy Shorthorns and Shire Horses. The chairman, Mr. H. Gates, and other members of the Aylesbury Branch of the N.F.U. co-operated with Messrs. Flowers in making the competition as interesting, instructive and comprehensive as possible.

* * * * * *

The Agricultural Index Number

THE general level of prices of agricultural produce during June was 41 per cent. above 1911–13, or one point lower than in the previous month and seven points below the figure of 48 per cent. for June, 1926. The fall of one point on the month was due principally to the reduction in the prices of fat sheep and pigs, and to the lower prices for old crop potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922:—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	—
August	68	52	57	54	49	—
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.—Wheat was 7d. per cwt. dearer on the month and the index figure was 7 points higher at 60 per cent. above the prices ruling in June, 1911-13. Barley at 11s. 5d. per cwt. was 54 per cent. above the level of the base years as compared with 46 per cent. in the previous month and 21 per cent. in June, 1926, while oats, at 7d. per cwt. dearer than in May, were 33 per cent. above pre-war and 2 points above the level recorded a year ago.

Live Stock.—Fat cattle showed a slight improvement in price during June, the movement being reflected in the rise of the index number from 24 to 25 per cent. above pre-war. Dairy and store cattle were somewhat cheaper, however, the former declining by about 15s. and the latter by about 10s. per head, Fat sheep were reduced by ¾d. per lb. estimated dressed carcass weight, as against a fall of ½d. per lb. in the corresponding period last year, and at 48 per cent. above pre-war were 5 points below the level of the previous month and 18 points lower than in June, 1926. Prices of store sheep have fallen slightly though much less than is usual at this period of the year; the index figure is 15 points higher on the month at 53 per cent. above 1911–13. Bacon pigs were 5d. and porkers 8d. per 14 lb. stone cheaper than in May, the index numbers being 54 per cent. and 60 per cent. above pre-war respectively. The corresponding figures a year ago were 87 and 90 per cent. Store pigs were also cheaper, but were still relatively dear compared with other items at 90 per cent. above pre-war.

Dairy and Poultry Produce.—During June egg prices hardened a little, and at 30 per cent. above pre-war were 2 points higher than in May and 4 points above the level of a year ago. Cheese was dearer by 1s. 6d. per cwt., and as there was a fall in price of 3s. per cwt. in the corresponding period of the base years the index figure rose by 8 points to 54 per cent. above pre-war. Butter was very slightly cheaper on the month at 41 per cent. above pre-war, and milk was unaltered in price or index number. Poultry prices were maintained at those ruling in May and the increase of 12 points in the index figure is due entirely to the fall in price in June of the base years.

Other Commodities.—There was an average reduction in prices of old potatoes of 4s. 6d. per ton during June, and the index figure fell 13 points to 61 per cent. above pre-war. Hay was little altered and wool was a little dearer at 33 per cent. above pre-war. Gooseberries have averaged practically the same prices as in 1926, but strawberries and cherries have been

dearer than last year. During June, gooseberries averaged 43 per cent., strawberries 54 per cent., and cherries 94 per cent. above 1911–13 in each case.

Index numbers of different commodities during recent months and in June, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	June	June	Mar.	Apr.	May	June
Wheat	62	71	57	52	53	60
Barley	38	21	38	41	46	54
Oats	38	31	14	18	27	33
Fat cattle	50	40	26	25	24	25
Fat sheep	93	66	45	53	53	48
Bacon pigs	54	87	63	61	58	54
Pork pigs	53	90	76	73	66	60
Dairy cows	47	38	25	26	24	21
Store cattle	43	28	27	23	23	21
Store sheep	115	71	41	40	38	53
Store pigs	55	134	116	108	99	90
Eggs	52	26	39	37	28	30
Poultry	61	70	34	25	41	53
Milk	55	60	56	63	53	53
Butter	57	54	40	43	42	41
Cheese	78	80	36	36	46	54
Potatoes	76	– 5*	85	60	74	61
Hay	3	9	—	– 1*	2	3
Wool	30	25	33	34	31	33

* Decrease.

* * * * * *

Agriculture and the International Economic Conference

THE article which appeared in last month's (July) issue of the JOURNAL, dealing with "Agriculture and the International Economic Conference," contained a verbal error on page 309. In the second paragraph on that page, and the eleventh line from the bottom, the word "prohibitions" was inadvertently given instead of the word "protection." The particular passage should, therefore, read : "to the reduction of customs protection both for industry and agriculture," etc.

* * * * * *

THE RESIDUAL VALUES OF FEEDING STUFFS AND FERTILIZERS*

Foreword.—Suggestions have been made and in some cases adopted for the revision of the tables drawn up by Dr. J. A. Voelcker and Sir A. D. Hall for values to be attached to manurial residues left upon the farm, due either to the consumption of feeding stuffs or to fertilizers purchased during the tenancy of the outgoing occupier. Since 1902, when these tables were originally drawn up, certain scientific evidence has been accumulated, which calls for revision of some of the data on which the original tables were based. The revision was in the first instance considered by a Committee composed of the leading agricultural chemists in Great Britain, and the report of this Committee will be found in Appendix B within. This report was then reviewed from the point of view of practicability by a Joint Committee including representatives of the various professional bodies. The constitution of this Joint Committee will be found within.

The Joint Committee agreed to present the report which follows to the various Associations represented. The representatives of the National Farmers' Union and the Central Association of Agricultural and Tenant Right Valuers dissented on the ground that the time was not opportune for any disturbance of the existing practice of valuation.

Constitution of the Joint Committee.

The Joint Committee was composed of the following :—

Scientific Committee	Sir A. D. Hall, K.C.B., LL.D., F.R.S. (Chairman). Sir E. J. Russell, D.Sc., F.R.S., Rothamsted Experimental Station. Prof. R. A. Berry, College of Agriculture, Glasgow. Dr. C. Crowther, Harper Adams Agricultural College. Dr. B. Dyer. Prof. J. Hendrick, Marischal College, Aberdeen. Dr. A. Lauder, College of Agriculture, Edinburgh. Mr. H. J. Page, Rothamsted Experimental Station. Dr. J. A. Voelcker. Prof. T. B. Wood, F.R.S., School of Agriculture, Cambridge.

* In accordance with the intention expressed on the formation of the Committee, the Report has been submitted to the Ministry of Agriculture and Fisheries and to the Board of Agriculture for Scotland. The Ministry of Agriculture and Fisheries does not propose to take any further action thereon.

Representatives of Professional Bodies

Auctioneers' and Estate Agents' Institute :—
Mr. A. W. Merry.
Mr. A. J. Burrows.
Central Association of Agricultural and Tenant Right Valuers :—
Mr. W. Gorbutt.
Mr. Harry A. Spencer.
Mr. C. B. Rolfe.
Land Agents' Society :—
Mr. W. J. Fleet.
Mr. A. J. Powlett.
Surveyors' Institution :—
The late Mr. H. M. Cobb.
Mr. Robert Cobb.
Mr. C. B. Fisher, C.B.E.
National Farmers' Union :—
Mr. R. R. Robbins, C.B.E.
Mr. H. German.
Mr. M. T. Davies.
Highland and Agricultural Society :—
Mr. J. T. McLaren.
National Farmers' Union of Scotland :—
Mr. J. Speir.
Scottish Chamber of Agriculture :—
Mr. Harry Armour.

Representing the Professional Bodies in Scotland

Sir James I. Davidson.
Mr. Jos. Murray.
The late Mr. A. A. Ralston.

Representing the Ministry of Agriculture.—Sir A. D. Hall.

Representing the Board of Agriculture for Scotland.—Mr. J. Mather.

Secretary.—Mr. H. H. Parker.

Report of the Joint Committee.

The reference to the Committee was confined to a consideration of the tables of Messrs. Voelcker and Hall as adopted by the Central Association of Agricultural and Tenant Right Valuers, published in 1914 and subsequently revised by Dr. Voelcker. The Committee does not propose any change in the system of valuation now existing, which is governed by the Agricultural Holdings Act of 1923, according to Section I of which a tenant is " entitled, at the termination of his tenancy, on quitting his holding to obtain from the landlord as compensation for the improvement such sum as fairly represents the value of the improvement to an incoming tenant," provided that (Section I, Clause 3) " nothing in this Section shall prejudice the right of a tenant to claim any compensation to which he may be entitled under custom, agreement, or

otherwise, in lieu of any compensation provided by this Section."

The findings of the Committee that follow deal solely with the construction of the tables originally drawn up by Voelcker and Hall and do not call for modifications in the method of applying them which are customarily adopted by valuers.

The recommendations of the Committee are based upon the general principle of endeavouring to assess the value to the incoming tenant of the residues of feeding stuffs consumed and manures applied during the occupation of the outgoing tenant. The recommendations of the Committee propose no change in the principles upon which the original tables of Voelcker and Hall were based. They represent certain modifications in detail which would, in the light of recent knowledge, result in a more accurate estimate of the value of the residues. The changes proposed are as follows :—

(1) The old tables were based upon an estimate that 50 per cent. of the nitrogen contained in the feeding stuffs would be found in properly made dung, and that one-half of this amount would still remain in the land after one crop had been grown with the dung.

In the proposed table the 50 per cent. would be reduced to 40 per cent., and a half only of this, *i.e.*, 20 per cent., would be allowed after one crop had been grown.

(2) The old tables made greater allowances when the feeding stuffs were fed upon the land. The new tables make no difference between food fed in the yards and food fed upon the land.

(3) It is recommended that a deduction of one-quarter should be made from the above allowances when the feeding stuffs are fed to dairy cows. Whether any greater deduction should be made must be left to the discretion of the valuer in each case, according to the extent he considers the urine from the cows has been preserved.

(4) It is recommended that in the case of phosphates other than basic slag one-sixth should be regarded as remaining in the soil in the third year after application.

(5) Where lime or any form of carbonate of lime has been applied it is to be regarded as suffering from exhaustion at the rate of 4 cwt. per acre per annum of pure lime or 7 cwt. per acre per annum of pure carbonate of lime.

The effect of these recommendations will be seen from the Tables, Appendix A, which have been recalculated on the new basis proposed, employing, however, the values for nitrogen, phosphoric acid and potash adopted by Dr. Voelcker in his revision of the old tables dated September, 1926.

Some difference of practice exists in the use of the tables. The old tables recommended the higher rate of allowance when no crop of which the outgoing tenant had realized the benefit had been grown by the residues of the feeding stuffs, and the half rate when only one such crop had been grown.

APPENDIX A.
VOELCKER AND HALL'S TABLE

TABLE SHOWING THE COMPOSITION, MANURIAL AND COMPENSATION VALUES OF FEEDING STUFFS
(Revised from Lawes and Gilbert's Tables, 1897, and Voelcker and Hall's Tables, 1902 and 1914)

No.	Foods	Valuation per Ton as Manure									Compensation value for each ton of food consumed D	
		A Nitrogen			B Phosphoric Acid			C Potash				
		Per cent. in food	Value at 14s. per unit	40 per cent. of value to manure	Per cent. in food	Value at 4s. per unit	Three-quarters of value to manure	Per cent. in food	Value at 3s. 6d. per unit	Three-quarters of value to manure	(1) Before one crop has been grown or removed	(2) After one crop has been grown or removed
			s. d.	s. d.		s. d.	s. d.		s. d.	s. d.	s. d.	s. d.
1	Decorticated cotton cake ..	6·90	96 7	38 8	3·10	12 5	9 4	2·00	7 0	5 3	53 3	26 7
2	Undecorticated cotton cake (Egyptian)	3·54	49 7	19 10	2·00	8 0	6 0	2·00	7 0	5 3	31 1	15 6
3	Undecorticated cotton cake (Bombay)	3·10	43 5	17 4	2·50	10 0	7 6	1·61	5 8	4 3	29 1	14 6
4	Linseed cake..	4·75	66 6	26 7	2·00	8 0	6 0	1·40	4 11	3 8	36 3	18 1
5	Linseed	3·60	50 5	20 2	1·54	6 2	4 7	1·37	4 9	3 7	28 4	14 2
6	Soya-bean cake	6·85	95 11	38 4	1·30	5 2	3 11	2·20	7 8	5 9	48 0	24 0
7	Palm-nut cake	2·50	35 0	14 0	1·20	4 10	3 7	0·50	1 9	1 4	18 11	9 5
8	Coco-nut cake	3·40	47 7	19 0	1·40	5 7	4 2	2·00	7 0	5 3	28 5	14 2
9	Earth-nut cake	7·62	106 8	42 8	2·00	8 0	6 0	1·50	5 3	3 11	52 7	26 3
10	Rape cake	4·90	68 7	27 5	2·50	10 0	7 6	1·50	5 3	3 11	38 10	19 5

No.	Foods	Valuation per Ton as Manure									Compensation value for each ton of food consumed D	
		A Nitrogen			B Phosphoric Acid			C Potash			(1) Before one crop has been grown or removed	(2) After one crop has been grown or removed
		Per cent. in food	Value at 14s. per unit	40 per cent. of value to manure	Per cent. in food	Value at 4s. per unit	Three-quarters of value to manure	Per cent. in food	Value at 3s. 6d. per unit	Three-quarters of value to manure		
			s. d.	s. d.		s. d.	s. d.		s. d.	s. d.	s. d.	s. d.
11	Compound Cakes, Meals, &c.:—											
	(a) exceeding 15 per cent. but not exceeding 20 per cent. Albuminoids											
	(b) „ 20 „ „ 25 „ „											
	(c) „ 25 „ „ 30 „ „											
	(d) „ 30 „ „											
12	Beans	4·00	56 0	22 5	1·10	4 5	3 4	1·30	4 7	3 5	29 2	14 7
13	Peas	3·60	50 5	20 2	0·85	3 5	2 7	0·96	3 4	2 6	25 3	12 7
14	Wheat	1·80	25 2	10 1	0·85	3 5	2 7	0·53	1 10	1 5	14 1	7 0
15	Barley	1·65	23 1	9 3	0·75	3 0	2 3	0·55	1 11	1 5	12 11	6 5
16	Oats	2·00	28 0	11 2	0·60	2 5	1 10	0·50	1 9	1 4	14 4	7 2
17	Maize	1·70	23 10	9 6	0·60	2 5	1 10	0·37	1 3	1 0	12 4	6 2
18	Rice meal	1·90	26 7	10 8	0·60	2 5	1 10	0·37	1 3	1 0	13 6	6 9
19	Locust beans	1·20	16 10	6 9	0·80	3 2	2 5	0·80	2 10	2 1	11 3	5 7
20	Malt	1·82	25 6	10 2	0·80	3 2	2 5	0·60	2 1	1 7	14 2	7 1
21	Malt culms	3·90	54 7	21 10	2·00	8 0	6 0	2·00	7 0	5 3	33 1	16 6
22	Bran and other offals of wheat	2·50	35 0	14 0	3·60	14 5	10 10	1·45	5 1	3 10	28 8	14 4
23	Brewers' grains (dried)	3·30	46 2	18 6	1·61	6 5	4 10	0·20	0 8	0 6	23 10	11 11
24	Brewers' grains (wet)	0·81	11 4	4 6	0·42	1 8	1 3	0·05	0 2	0 1	5 10	2 11

APPENDIX A.
VOELCKER AND HALL'S TABLE (*continued*)
TABLE SHOWING THE COMPOSITION, MANURIAL AND COMPENSATION VALUES OF FEEDING STUFFS
(Revised from Lawes and Gilbert's Tables, 1897, and Voelcker and Hall's Tables, 1902 and 1914)

No.	Foods	Valuation per Ton as Manure									Compensation value for each ton of food consumed D	
		A Nitrogen			B Phosphoric Acid			C Potash				
		Per cent. in food	Value at 14s. per unit	40 per cent. of value to manure	Per cent. in food	Value at 4s. per unit	Three-quarters of value to manure	Per cent. in food	Value at 3s. 6d. per unit	Three-quarters of value to manure	(1) Before one crop has been grown or removed	(2) After one crop has been grown or removed
			s. d.	s. d.		s. d.	s. d.		s. d.	s. d.	s. d.	s. d.
25	Clover hay	2·40	33 7	13 5	0·57	2 3	1 9	1·50	5 3	3 11	19 1	9 6
26	Meadow hay	1·50	21 0	8 5	0·40	1 7	1 2	1·60	5 7	4 2	13 9	6 10
27	Wheat straw	0·45	6 4	2 6	0·24	1 0	0 9	0·80	2 10	2 1	5 4	2 8
28	Barley straw	0·40	5 7	2 3	0·18	0 9	0 6	1·00	3 6	2 7	5 4	2 8
29	Oat straw	0·50	7 0	2 10	0·24	1 0	0 9	1·00	3 6	2 7	6 2	3 1
30	Mangels	0·22	3 1	1 3	0·07	0 3	0 2	0·40	1 5	1 1	2 6	1 3
31	Swedes	0·25	3 6	1 5	0·06	0 3	0 2	0·22	0 9	0 7	2 2	1 1
32	Turnips	0·18	2 6	1 0	0·05	0 2	0 1	0·30	1 1	0 9	1 10	0 11

TABLE OF COMPENSATION FOR FERTILIZERS APPLIED

FROM SUCH DATA AS ARE AVAILABLE THE FOLLOWING SCALE OF COMPENSATION MAY BE TAKEN AS SOME GUIDE

	On Arable Land			On Grass Land						
	After 1st crop	After 2nd	After 3rd	After 1st year	After 2nd	After 3rd	After 4th	After 5th	After 6th	After 7th
*Superphosphate	⅔ of cost	⅓	⅙	⅔ of cost	⅓	⅙	—	—	—	—
*Bones (raw and steamed)	⅔ ,,	⅓	⅙	⅔ ,,	⅓	⅓	⅙	—	—	—
Dissolved bones	½ ,,	¼	1/12	½ ,,	¼	1/12	—	—	—	—
*Basic slag and ground mineral phosphate	⅔ ,,	⅓	⅙	⅞ ,,	¾	⅝	½	⅜	¼	⅛
Bone manures	⅖ ,,	⅕	—	⅖ ,,	⅕	—	—	—	—	—
Compound manures not containing bone	⅓ ,,	⅙	—	⅓ ,,	⅙	—	—	—	—	—
Peruvian guano	⅓ ,,	⅙	—	⅓ ,,	⅙	—	—	—	—	—
Fish guano	⅓ ,,	⅙	—	⅓ ,,	⅙	—	—	—	—	—
Meat meal	⅓ ,,	⅙	—	⅓ ,,	⅙	—	—	—	—	—
Shoddy and wool waste, fur waste, hair, hoofs and horns, greaves, &c.	½ ,,	¼	⅛	½ ,,	¼	⅛	—	—	—	—
Manure cakes	⅕ ,,	1/10	—	⅕ ,,	1/10	—	—	—	—	—
Dried blood, sulphate of ammonia, nitrate of soda, nitrate of lime, cyanamide	Nothing			Nothing						
Kainit and potash salts	½ ,,	¼	—	½ ,,	¼	—	—	—	—	—
Lime: Deduct 4 cwt. of pure lime (or 7 cwt. of carbonate of lime) per acre	per annum									

* The Valuer must exercise his discretion as to the suitability of these manures when used upon grass land.

These tables are based on the assumption that the manure in question is one suitable for the land. The tables can only be interpreted with considerable latitude, depending upon such varying factors as the nature of the soil, the course of cropping pursued, the climatic conditions, &c. Further, when it is clear from the invoice, or when expert opinion has been brought to show that an excessive price has been charged for a manure purchased by an outgoing tenant, the Valuer is justified in exercising discretion as to the deduction he may make in the original price charged, and on which the compensation to be paid shall based.

The tables are intended, therefore, for general guidance, to be modified as circumstances demand.

When the dung had been applied but no crop had resulted, *e.g.*, in the case of dung applied for a turnip crop that failed, the residues would be regarded as exhausted in the same way as if a crop had been grown. Catch crops would not be taken into account.

Some valuers, however, have paid no attention to the crops grown, but consider only the year in which the feeding stuffs had been consumed, awarding the higher values for those consumed in the last year of the tenancy and the half values for such as were consumed in the previous year, without taking into account exhaustion by cropping.

The recommendation of assessment according to crops grown is the more accurate; the method, by years, is more easily applied and in some cases gives substantially the same results.

The tables will still require re-assessment from time to time in accordance with the variation in the market price of manures. To this end, the Committee recommends that the Ministry of Agriculture and Fisheries and the Board of Agriculture for Scotland should jointly appoint a standing Committee consisting of two scientific men, one valuer and two farmers to recalculate the tables each year.

APPENDIX B.

REPORT OF THE SCIENTIFIC COMMITTEE.

The Committee, appointed to consider the revision of Voelcker and Hall's tables of manurial values from the purely scientific point of view, consisted of Sir Daniel Hall, Sir John Russell and Mr. H. J. Page of Rothamsted, Professor T. B. Wood of Cambridge, Dr. J. A. Voelcker, Dr. B. Dyer, Dr. Crowther of the Harper Adams College, Dr. Berry of the West of Scotland Agricultural College, Dr. Lauder of the Edinburgh and East of Scotland Agricultural College, and Professor Hendrick of the North of Scotland Agricultural College. After consideration of the scientific evidence available, the Committee made the following recommendations :—

Compensation for Feeding Stuffs Consumed by Cattle or Pigs Making Farmyard Manure.

(1) Compensation should be limited to feeding stuffs consumed within the last two years of the tenancy, provided that not more than one crop has been grown on the land to which the dung has been applied, or provided that such compensation has not been paid for otherwise.

(2) If no crop has been grown, the table of compensation should be constructed on the same basis as that adopted by Voelcker and Hall, except that the amount of nitrogen in the feeding stuff that is to be regarded as passing to the land should be taken as 40 per cent. of that contained in the food-stuff instead of 50 per cent. as taken by Voelcker and Hall. The proportions (three-quarters) of phosphoric acid and potash adopted by Voelcker and Hall should be retained.

(3) As regards the unit values to be attached to nitrogen, phosphoric acid and potash, it is recommended that a small standing committee should be appointed to fix these values each year. As regards nitrogen, the value should be that derived from the current London price of sulphate of ammonia or whatever analogous (*i.e.*, concentrated soluble) nitrogenous fertilizer is cheapest at the time. As regards phosphoric acid, one-half of the current price of phosphoric acid in super-phosphate is to be taken, and, as regards potash, the value of the unit of potash in potash salts.

(4) The compensation value for feeding stuffs consumed in the penultimate year of the tenancy should be one-third of the values that would be attached to them if no crop had been grown, instead of one-half as now given.

Compensation for Feeding Stuffs Consumed by Dairy Cattle.

(5) The Committee specially considered the value of the manure resulting from the feeding of dairy cattle. It was unanimous that some deduction from the 40 per cent. of nitrogen passing to the manure, which it had adopted for feeding cattle and pigs, should be made in the case of dairy cattle. In cases where the urine is not received in the dung-heap or otherwise applied to the land, the Committee recommends that valuers should be instructed to make a heavy deduction varying with circumstances, but under the best farming practice the Committee is of opinion that the compensation values to be allowed for feeding stuffs consumed by dairy cattle should be put at two-thirds of the values adopted for other stock.

Compensation for Feeding Stuffs Consumed upon Grassland.

(6) Experience has gone to show that where cattle and sheep are fed on grass, the improvement cannot be assessed at as high a figure as the authors of the previous tables had accepted. The evidence on the subject is not altogether conclusive, but the Committee agreed that grassland, especially when poor or very rich, may sometimes derive little benefit from the feeding of cake or corn upon it, and recommends that the maximum

rate of compensation in such cases should be at not more than one-half of the usual rates of compensation.

Compensation for Feeding Stuffs Consumed by Sheep upon Arable Land.

(7) In cases, however, where the feeding stuffs are consumed by sheep fed on arable land, the usual rates of compensation should be applied.

Compensation for the Unexhausted Values of Fertilizers.

(8) With regard to purchased fertilizers, the Committee felt that it had not sufficient data which would lead it to suggest a revision of the method of calculation used in the former table. The Committee decided to recommend, however, a slight modification in respect of the third year in the case of phosphates, other than basic slag, which should now be taken at one-sixth of cost.

Compensation for the Unexhausted Value of Lime, etc.

(9) Lime and the various forms of carbonate of lime, in the opinion of the Committee, require special treatment for the purposes of assessing compensation. Following the method adopted in this connexion by a recent Scottish Committee which investigated the subject, the Committee recommended that valuers should be instructed to allow for a rate of exhaustion of 4 cwt. per acre per annum in the case of lime, and of 7 cwt. per acre per annum in the case of carbonate of lime.

(10) The Committee recognizes that an improvement in the fertility of a farm can have been effected by the use, even in the earlier years of the tenancy, of fertilizers like nitrate of soda or sulphate of ammonia, which are not included in the table. In these cases, however, no residuum is left in the soil to which a value may be directly attached. The improvement, if any, like that due to continuous good farming, must be assessed by the valuer on the evidence that is laid before him.

(11) In addition to the compensation payable for consumed feeding stuffs,compensation may still be awarded for the amount of farmyard manure actually left upon the farm, but this should be determined by the work that may be regarded as having been spent in making the manure.

The Committee has taken as the basis of its recommendations the direction of the Agricultural Holdings Act of 1908 that the compensation payable to the outgoing tenant should be "such as fairly represents the value of the improvement to an incoming tenant." It would appear to follow from this instruc-

tion that it is not allowable to attach a value to materials left in the soil or upon the farm by the outgoing tenant should the circumstances of the farm render it impossible for the incoming tenant to derive any benefit from those materials.

As regards all its recommendations, the Committee desires to lay stress upon the fact that the values given are to be regarded as maxima under good ordinary farming conditions, to be modified at the discretion of the valuer on the evidence before him of the conditions prevailing upon the particular farm.

The Committee presents these recommendations as the scientific conclusions to be drawn from the evidence available. It will be for the wider Committee to decide to what extent they can be adopted for practice. The Committee would again wish to emphasize the fact that the figures represent maximum values, from which considerable deductions may require to be made according to the conditions prevailing on each farm.

* * * * * *

HERBAGE SEED PRODUCTION IN NEW ZEALAND:

III.—COCKSFOOT

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Welsh Plant Breeding Station, Aberystwyth.

COCKSFOOT was one of the first grasses to be used in quantity by the first settlers in New Zealand. It was largely employed for the original seeding out after burning the bush. It succeeded and maintained itself well on the richest lands, and for many years, with perennial rye-grass, was regarded as a pivotal species for such purposes. Subsequently, it has been found not to retain its hold on all classes of soils as long as earlier experience seemed to indicate, and recent investigations conducted by Mr. Bruce Levy, of the Fields Division of the Department of Agriculture, under the guidance of Mr. A. H. Cockayne, the Director of the Division, have led to a considerable modification of the mixtures employed, especially on the poorer lands. Regard being had to the needs of the country as a whole, less reliance, in consequence, is being placed on cocksfoot than formerly.

Before 1914, New Zealand had become self-supporting in the matter of cocksfoot seed and was, moreover, at the commencement and during the early years of the century, a large exporter of this seed to Europe. At that period, about

30,000 acres were devoted to seed production, and the crop of dressed seed frequently exceeded 2,000 tons. The area under seed crops has gradually dwindled and now seems, at least temporarily, to have stabilized at no more than approximately 11,500 acres with an output, in 1925, of but 845 tons and an export of only 65 tons. An appreciable quantity of the latter amount would have been absorbed by Australia, so that New Zealand has ceased to be an important producer of cocksfoot seed for the European market. The Dominion does not, in fact, now satisfy her own local demand, and much more cocksfoot seed (chiefly of Danish origin) is imported than is exported.

Economic Considerations.—This great change has been due to a number of contributory causes, of which the following are the most important :—

(1) The methods of specialized seed production adopted in Denmark have made it possible for Danish seed of high viability and purity to be put on the market not only in Europe, but in Australia and New Zealand, at a lower price than is possible under the New Zealand methods.

(2) The development of the New Zealand dairy industry has provided new openings for utilizing much of the cocksfoot-seed producing area in the Dominion.

(3) Difficulties connected with harvesting seed on rough and hilly country and the high cost of labour—since much of the seed must be harvested by hand.

(4) The viability of the New Zealand seed is on the average lower than that of Danish, while the bushel weight is also lower and the general appearance of the seed less attractive to the eye.

(5) A lack of appreciation in the Dominion itself, in Australia, and in Europe, of the particular purposes for which New Zealand cocksfoot is pre-eminently suited. In regard to seed transactions, the question of strain has been much neglected, price having been the dominant consideration. The only factors (other than cost of production and cost of placing on the world's markets) influencing large-scale demand have been germination, purity and bushel weight, in respect to all of which (as well as cost of production) New Zealand seed tends to be at a considerable disadvantage compared with Danish and American.

(6) The use of modified and better-balanced mixtures for the first sowing out on many classes of land in the Dominion, and the fact that most of the areas best suited to cocksfoot

have been long since cleared and grassed out. There are indications, however, that, in proportion as long-duration leys, in the proper sense of the word, become more generally relied upon, cocksfoot will again come into greater demand.

Seed Production in Relation to Habitat.—The great bulk of the seed crop is taken from the Akaroa district of the Banks Peninsula, and from the Canterbury Plains. Seed is also harvested, to some extent, locally in Otago and Southland, and has also been harvested, chiefly for local consumption, and on a small scale, in isolated districts in the North Island.

It is very important to notice, and for reasons that will be explained in a subsequent section, that, in the main, seed is harvested from what are tantamount to, or have for years been, waste places, and not to any extent from well-cared-for temporary grass as understood in this country. That is to say, the seed has been harvested from areas long in cocksfoot and not from fields of a temporary nature, or from fields treated in a similar manner to pastures in this country. Even in the Canterbury Plains, probably over 90 per cent. of the cocksfoot is not taken from enclosed farm lands.

Akaroa.—The soil of this district is a deep, rich, volcanic loam, and the country is hilly, attaining to over 2,000 feet above sea level. The burning of the bush was started over 60 years ago, and during the past 40-60 years the entire area has been sown out with cocksfoot. Whole farms in the Akaroa district now consist of nothing but cocksfoot sown over 40 years ago on the original bush burn. The soil and the methods adopted have alike been favourable to the permanency of cocksfoot, and consequently we have the unusual phenomenon of a tract of country, which must considerably exceed 10,000 acres, consisting of an almost closed association of this grass. In the early days, cocksfoot seed production was the chief industry on the Banks Peninsula, large areas being devoted almost entirely for the purpose. The stocking, such as it was, was then exceedingly light. In recent years, since cheese-making has become more remunerative than the collecting of cocksfoot seed, the stocking has become heavier and more normal, with the result that even the areas devoted to seed production are now largely subservient to milk production.

The present, usual practice is to assign certain paddocks to seed production and to take a crop of seed every year for a large number of years. After cutting the seed, the long stubble is allowed to stand and, becoming mixed with an abundant aftermath growth, constitutes the main winter feed (*in situ*)

for the dairy cattle. The tendency, however, is to graze too long into the spring and not to put the paddocks up to seed early enough, with the result that the yields per acre on the Peninsula are not considered to be as high as formerly.

Some of those who still harvest cocksfoot seed put up different paddocks every year for seed, thus taking seed from fields which, in the matter of their general management, would to-day (but not necessarily during previous years) compare closely with that of a permanent pasture in this country.

The stock-carrying capacity of some of these all-cocksfoot farms is truly remarkable, the more so when it is realized that often no roots are grown and no hay made, the cattle being out-wintered on the pastures and on the cocksfoot stubble-aftermaths ; and, although top dressing is now popular in New Zealand, the practice is not much in evidence on the Peninsula. As a typical example of stock-carrying capacity, a farm, visited by the writer, with a total area of 1,179 acres, of which 300 were devoted annually to seed and stubble-aftermath production, carried 150 dairy cattle, 40 fatting beasts, 70 dry cows, and about 12,000 sheep.

Canterbury Plains.—Akaroa has been very largely the distributing centre of cocksfoot seed all over the Dominion, so that " Plains " seed is to be regarded, to an appreciable extent, as Akaroa " once grown." Most of the Canterbury seed is harvested from the broad roadsides and railway sides and from areas of a similar nature. The ground is level and uniform and, in the main, this seed is now harvested with the self-binder.

Seed Production Trials.—Trials have been conducted by growing cocksfoot in spaced drills specially for seed production, on the Danish plan, and in some cases high and satisfactory yields have been obtained. No appreciable amount of seed, however, is grown at present on this basis, and the matter calls for further experimentation ; the more so since, as the writer was informed, the cost of handling the crop was out of all proportion less than the costs of hand-harvesting on the Peninsula. It would also appear that high manuring, including nitrogenous fertilizers, has not been fully tested. The Danish trials have, however, shown that the seed yields are much increased when supported by adequate and complete manurial dressings.

Harvesting Practices.—In the Akaroa district, the paddocks are usually shut up for seed in September and harvested in December or early January. In this hilly country, the seed

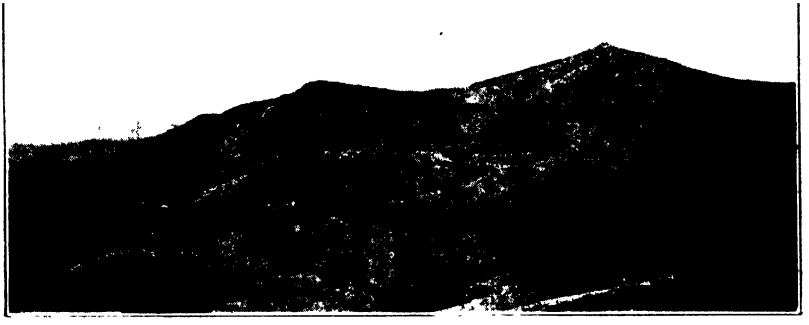

FIG. 1.—Typical Akaroa country. The whole area shown is dominated by cocksfoot. The light patch in the foreground to the left, and running up the hillside in a narrow rectangle, constitutes an area from which seed was harvested and was standing in stubble when the photograph was taken (June, 1926).

FIG. 2.—Typical Akaroa country. The whole area shown is dominated by cocksfoot (June, 1926).

Copyright photos R. G. Stapledon.

FIG. 3.—Typical Akaroa country. The paddock beyond the fence had been harvested for seed and is shown in stubble. Note the large patches of yarrow near the fence and in the middle of the stubble paddock (June, 1926).

Copyright photograph: R. G. Stapledon.

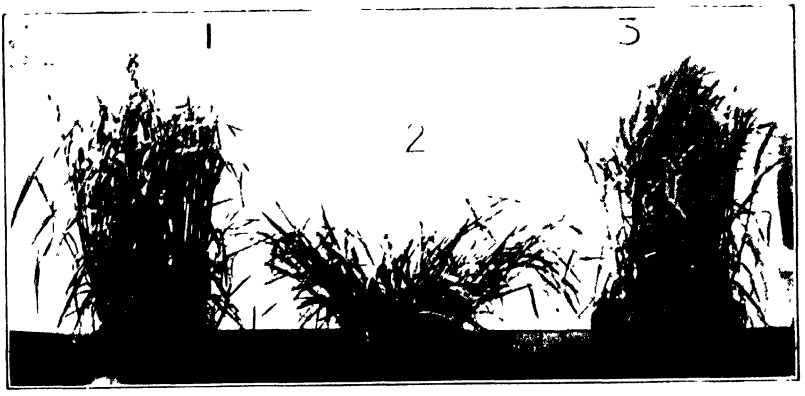

FIG. 4. The most desirable types of cocksfoot met with from Danish seed. Note the stemmy nature of the plants and that panicles are already exserting (May 21, 1925).

FIG. 5. – The more desirable types of cocksfoot chiefly met with from amongst seed collected from thickets and waste places in Britain, and from seed harvested in the Akaroa and Canterbury Plains districts of New Zealand. Note density and leafiness of plants and that panicle exsertion has not commenced (May 21, 1925).

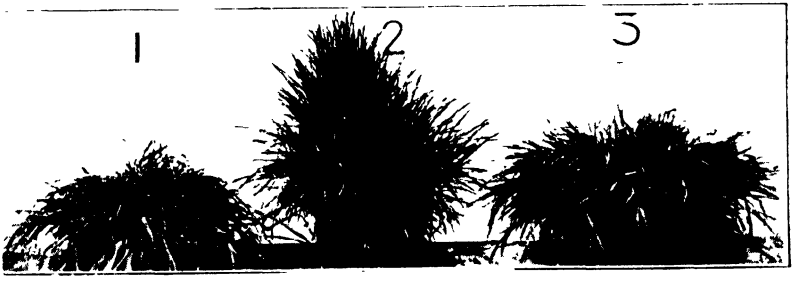

FIG. 6.—The more desirable types of cocksfoot chiefly met with from collections made on the Leicestershire fattings pastures and from other old pastures in Britain. Note the excessively dense and cushion-like growth of the plants and that panicle exsertion has not commenced (May 21, 1925).

Copyright photographs: Welsh Plant Breeding Station.

is wholly—as much of it necessarily must be—cut by hand with sickles. It is cut at a convenient height for collecting the heads and brought to suitable centres on the paddock, where the seed is usually thrashed by hand with the flail. Small mills, however, driven by a 4 h.p. motor, are now used to a certain extent.

On account of the cost of labour, insufficient care is often paid to harvesting the different hillsides (sunny and dark faces) as and when the seed is ripe; because of the risk of shedding, due to high winds, the tendency appears to be to cut too green. It was easier to regulate these matters when seed was harvested on a large scale and when considerable gangs of men were employed for the purpose. The crop per acre runs at about 150 to 200 lb., although, on some of the better paddocks, yields of 400 lb. are not unusual. The chief plants other than cocksfoot are Yorkshire fog and yarrow, with a certain amount of brown top (*Agrostis vulgaris*) and yellow suckling clover; while red clover is still surprisingly abundant (although never sown since the original bush burn) on some of the paddocks. Cocksfoot is, however, always the dominant plant, and is frequently the only grass occupying large areas of ground.

Characteristics and Agricultural Usefulness.—Different lots of New Zealand cocksfoot do not show so much variation as is the case with New Zealand white clover. In the main, New Zealand cocksfoot is wholly a product from land not recently ploughed. Broadly speaking, it is a distinct commercial commodity, differing widely, in the aggregate, from either Danish, French, or American; and, while Danish cocksfoot is appreciably used in New Zealand, it would seem that seed crops are not to any extent taken from areas sown with Danish seed. There would also seem to be but little risk of the ordinary New Zealand stocks, as such, being cross-fertilized by Danish. It is probably true to say that not a single lb. of Danish seed has ever been sown in the Akaroa district; and since the majority of the leys in the Canterbury district are rye-grass-clover leys, and that the locally-produced cocksfoot is usually employed when this species is included in the mixtures, up to the present, at all events, the amount of Danish seed sown in that district must be very slight and almost negligible.

Extensive and critical trials conducted at Aberystwyth have, indeed, shown very little consistent difference between Akaroa and Plains cocksfoot, and this is largely what is to

be expected, having regard to the methods of seed production employed in the two areas. Akaroa, if preferable to Plains, is only so because seed from the former source is almost certain to be unrelated to Danish, while an occasional lot from the Plains may have grown in juxtaposition to a ley containing Danish cocksfoot or, conceivably, may have been Danish "once grown."

Emphasis has been laid on the fact that New Zealand cocksfoot, harvested for seed, is to a marked degree grown rather under thicket or waste place conditions than under temporary ley or normal permanent grass conditions. Seed is most usually taken year after year from the same positions and from areas not heavily grazed, or, at all events, from areas that, in past years, have more resembled thickets than intensively grazed pastures. The seed is, moreover, taken from areas long in cocksfoot. It is to be remembered, also, that when cocksfoot was first introduced into the Akaroa district, some 60 odd years ago, specialized seed production had not become established in Europe; consequently, the seed then going to New Zealand would scarcely have been of the modern Danish type but rather of the type associated with waste places and older grasslands from which it would in fact have been collected.

A critical comparison of representative plants of Danish (modern), New Zealand, British (indigenous) waste place, and British (indigenous) old sward (Leicestershire) shows exceedingly interesting differences. Certain types of individual plants will be common to all of the above sources of origin.

At the two extremes, however, we have on the one hand the early, rather stemmy, broad-tillered and lax strains most prevalent in the Danish, and on the other hand the very late short growing, excessively leafy and dense pasture types dominant in collections made from our Leicestershire and other old pastures. Intermediate between these we get forms which are more abundant amongst plants derived from New Zealand seed, and in collections made from our waste places and thickets, than in any other lots. There are also plants which are tall, leafy, exceedingly bulky and dense, and which, from an agricultural point of view, may be regarded perhaps as dual purpose—hay and pasture. The illustrations of single plants accompanying this article, and the descriptions given under them, show clearly the sort of differences that are met with amongst truly representative plants of each of the categories mentioned. In this connexion, it is not without

significance that a very large number of the plants selected at Aberystwyth for breeding purposes emanated from seed received from New Zealand.

There is, in short, not the least doubt that a large proportion of the strains produced by New Zealand seed approximate to and are hardly to be distinguished from much of our indigenous or wild cocksfoot, and abundantly represent strains which are bulky, leafy, high tillering and relatively persistent.

This conclusion is not only borne out by a critical examination of single-spaced plants but is equally confirmed by the behaviour of broadcast plots sown with New Zealand seed, when compared with indigenous strains under study at Aberystwyth and with ordinary Danish strains.

The above facts, taken in conjunction with what has already been stated in previous articles concerning white clover and red clover, afford an illuminating commentary on the relation of methods of seed production to the strains actually dominating the seed harvested. The difference between plants of cocksfoot, chiefly representative of types dominant on our fatting pastures and those representative of types dominant alike in New Zealand and in our thickets, is no less of biological than of agricultural interest and significance.

General Conclusion and Recommendations.—In view of the fact that the tendency more and more in this country, as in Australia and New Zealand, is to put land down to temporary grass for as many years as possible—a tendency which is strengthened by modern methods of more intensive manuring of grassland—it is to be deplored that the relatively short-lived strains of cocksfoot as represented by Danish seed have become the dominant strains which are sown on newly prepared leys. At equal price per pound, Akaroa cocksfoot cannot hope to compete in the world's market with Danish, because its viability and bushel weight are generally lower, and its appearance less attractive to the eye, than that of the latter. In the interests of the grasslands of the Empire, however, it is to be hoped that some stimulus could be given to the Akaroa growers to continue the production of seed. There is little doubt that seed production could be cheapened on the more accessible and more level of the paddocks, and that resort to adequate manurial dressings and greater specialization would lead to considerably augmented yields. There remains also the possibility of developing the cocksfoot

seed industry of New Zealand on the lines of "once growing" the best Akaroa strains under arable conditions, and in seed production drills (the Danish plan) on the Canterbury Plains or elsewhere, where the conditions are favourable to the growth and harvesting of this species. It is probable that methods demanding excess of manual labour can never again be remunerative and, consequently, developments can only take place on the lines of the scientific selection of areas for the production of "stock seed" and for the "growing on" of this seed under arable conditions, supported by a properly conceived system of inspection and registration.

In this connexion, it is legitimate to insist that the breeding and selection of true-breeding and ultra-superior strains is, at the best, a long process; and, in the meantime, it is wholly to the disadvantage of the British farmer that Denmark should have been allowed, to all intents and purposes, to completely replace New Zealand as a source of supply for the seed of such an important species as cocksfoot. The question to which the New Zealand grower and the British importer should, therefore, give serious attention is whether it is possible to stay the decline in the amount of New Zealand cocksfoot seed reaching this country.

* * * * * *

LIVE STOCK IMPROVEMENT SCHEME: REPORT FOR THE YEAR ENDING MARCH 31, 1927

IT is probably true that, during the year under review, agricultural conditions in many districts offered little inducement to the average farmer to venture upon any stage of development of his industry which involved an outlay beyond what was necessary to carry on his normal activities. The small farmer, with limited resources, for whose benefit, primarily, the Live Stock Scheme was started, has felt in varying degree the difficulty of making ends meet. His problem has been that of reducing expenditure rather than that of incurring additional liabilities on new ventures. The dispiriting influence of these conditions is not conducive to development, and, in the definitely progressive programme of the Live Stock Scheme, which makes a call upon enterprise and necessitates a measure of optimism in spending, it would not be surprising to find the effects of these conditions somewhat pronounced.

Under the necessity of reducing expenditure, the temptation to effect a saving at the sacrifice of development is naturally

a strong one, especially to those who do not realize the financial and other benefits that accrue from the use of pedigree sires and the adoption of a system of recording milk yields. It may, therefore, be regarded as one of the satisfactory features of the year's operation of the Live Stock Scheme that, in spite of the agricultural difficulties, there has been a measure of progress, not only in influencing new areas, but also in developing the good work already accomplished. The Scheme is slowly, but surely, penetrating into districts which have hitherto been too conservative in their methods to adopt it, and the location of a premium bull in a district so remote as the Scilly Isles may perhaps be regarded as a happy augury of further progress.

Bulls.—The total number of bulls available for service under the Scheme during the year ended March 31, 1927 (*i.e.*, continued from the previous year with renewed grants, or provided for fresh districts during the year), was 1,287, an increase of 112 on the preceding year.

BULL SCHEME

SHOWING THE NUMBER OF BULLS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME

Year (April 1-March 31)	No. of Bulls
1914-15*	497
1915-16	633
1916-17	659
1917-18	710
1918-19	721
1919-20	675
1920-21	668
1921-22	847
1922-23	947
1923-24	978
1924-25	1,069
1925-26	1,175
1926-27	1,287

* Including the period February 1, 1914, to March 31, 1914.

Considering the difficulties which confront the Ministry's Live Stock Officers in their efforts to extend the scope of the Bull Scheme, the progress made during the year may, on the whole, be regarded as satisfactory. Apart from the prevailing lack of funds, which deters farmers from paying the price required for a pedigree bull, local difficulties, more severe in some districts than in others, have retarded progress. For example, in districts which are almost entirely devoted to milk production little attention is paid to the breeding and conformation of bulls, with the result that the calves

produced are not fit to rear, and are usually disposed of at the first market after they are dropped. In some districts, too, there appears to be a general fear, usually without foundation, that the use of a premium bull is attended by risks of spreading abortion. Another factor which makes the location of sires difficult is the high cost of carriage. Unfortunately, in many districts where the location of good sires would be of great benefit, few pedigree herds exist, and, in consequence, good bulls have to be drawn from remote areas and the cost of transit in addition to the purchase price of a good bull discourages many farmers who might otherwise be disposed to keep a bull under the Scheme.

These considerations combine to induce many farmers to purchase bulls, for use in their own herds, which are often below the standard required to exert a beneficial effect on the live stock of the district. Even in these cases, the fact that the pros and cons have often been considered by the farmer is a hopeful indication, and it is not improbable that, in due course, growing evidence of the ultimate benefit of the use of good sires will lead to the purchase of better bulls. There is, indeed, ample evidence that premium bulls exercise an influence that reaches beyond the immediate districts in which the bulls are placed. While the awards obtained by premium sires and their progeny at the more important shows are a good advertisement for the Scheme, it is probable that the frequent successes of subsidized sires at numerous local shows are no less effective in demonstrating in their respective areas the benefit of using good sires. The list of such successes furnished to the Ministry by its Live Stock Officers each year is a growing one, and shows beyond doubt that the Scheme has an increasing educational value, and is effecting an improvement in stock breeding which is recognized by both breeders and dealers. Moreover, a marked preference for young stock sired by premium bulls is now reported very generally and is one of the most practical proofs of the ultimate benefits of the Scheme. A heifer calf sired by a Scheme bull was recently sold at 18 months old for £50, while two eight weeks old heifer calves realized an average of £8 10s. 0d.

The sequel is often more instructive than the event, and it is in the activities which are obviously prompted by the Scheme that its progress may be traced. A distinct advance has been made in one district by the adoption of a system of marking of calves sired by premium bulls, and if this practice proves a financial success it will probably be tried

in many other districts. It is satisfactory, also, to record that the provision of classes for premium bulls at shows has increased, and that the very desirable practice of extending such classes to include the progeny of premium bulls has been further adopted.

While it is encouraging to find that, in many districts, where the Scheme has operated successfully for several years, breeders have continued to make use of pedigree sires, it should be remembered that the funds available for the provision of premium bulls are quite insufficient to provide sires in sufficiently large numbers to have a widespread effect on the general grading up of the commercial cattle of the country. The question of the elimination of the scrub bull remains as important as ever and cannot be solved by the Premium Scheme. As to the introduction of legislation to secure this object; there is still strong agricultural opposition, but there are indications that the proposal is growing in favour in some districts.

Breeds and Prices.—The following table compares the numbers and prices of bulls according to breeds with the preceding year and the first year of the Scheme. The Shorthorn breed furnishes nearly 60 per cent. of the total number of bulls, the increase in this breed alone being equivalent to about 80 per cent. of the total increase for the year.

NUMBERS AND PRICES OF BULLS OF EACH BREED

Breed	1914-15				1925-26				1926-27			
	No.	Average Cost			No.	Average Cost			No.	Average Cost		
		£	s.	d.		£	s.	d.		£	s.	d.
Aberdeen Angus	—	—			1	52	10	0	3	48	3	4
British Friesian	—	—			3	58	8	4	2	58	12	6
Devon	16	40	17	6	128	55	6	11	136	54	6	4
Galloway ..	—	—			—	—			1	19	19	0
Guernsey ..	—	—			13	48	0	0	12	43	19	11
Hereford ..	63	33	7	6	121	48	3	9	142	48	4	1
Lincoln Red ..	33	31	10	0	132	59	0	7	141	48	3	10
Red Poll ..	—	—			1	21	0	0	—	—		
Shorthorn ..	337	37	17	0	644	55	4	3	716	52	6	3
South Devon ..	6	36	11	6	14	43	16	8	14	43	2	8
Sussex	—	—			1	44	2	0	—	—		
Welsh Black ..	35	29	9	0	67	43	18	6	69	45	1	6
All breeds	497 *	£36	0	0	1125	£53	19	9	1236 †	£50	19	6

* Including 7 " other breeds " not specified.

† 1,287 bulls were located, but grants in respect of 51 were in suspense at the end of the year.

Service Fees.—With three exceptions exceeding 10s., the bulls served at fees ranging from 2s. 6d. to 10s. While little change is shown in the number of bulls serving at fees other than 5s., there was a very substantial increase in those serving at that amount.

Year	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6
1914-15 ..	265	57	41	42	3	88	—	—	—
1925-26 ..	55	50	25	74	13	616	5	108	2
1926-27 ..	67	52	34	78	13	691	7	108	3

Year	7/-	7/6	8/-	8/6	9/-	9/6	10/-	Over 10/-
1914-15 ..	—	1	—	—	—	—	—	—
1925-26 ..	8	140	4	5	1	1	15	3
1926-27 ..	12	140	5	4	1	1	17	3

Boars.—The number of boars provided for service under the Scheme during the year ended March 31, 1927 (*i.e.*, continued from the previous year with renewed grants or located in fresh districts during the year), was 844, an increase of 134 over the preceding year.

BOAR SCHEME

SHOWING THE NUMBER OF BOARS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME

Year (April 1 to March 31)	Societies	Individuals	Total number of Boars
1914-15* ..	115	—	115
1915-16	180	—	193
1916-17	186	15	216
1917-18	172	92	264
1918-19	156	167	350
1919-20	120	225	399
1920-21	135	285	441
1921-22	113	416	550
1922-23	93	451	569
1923-24	78	541	638
1924-25	68	587	655
1925-26	57	649	710
1926-27	54	790	844

* Including the period February 1, 1914, to March 31, 1914.

On the whole, the year under review was a good one for the pig breeding industry. A rise in prices realized for pigs and an increased demand for pig products gave an impetus to the keeping of breeding sows. The history of this industry, however, does not encourage the hope that this improvement will be constantly maintained, and, with any serious drop in prices, no doubt the interest of a number of farmers in this side of farming will be decreased or cease altogether. This uncertainty in the pig breeding industry may possibly be checked to some extent by an effort, which appears to be growing, to establish a better understanding between breeders on the one hand and the bacon factory and the market on

the other. It appears to be clear that, unless something in this way is accomplished, pig breeding will continue to fluctuate and remain with most farmers a side line, active only when the market is good.

Breeds and Prices.—The following table shows the number and average prices of boars of each breed. It will be readily apparent that the Large White breed, which has always been predominant under the Scheme, has further increased in popularity.

There was a slight rise in the average price paid for most breeds, which resulted in a small increase in the average price for the total number provided.

NUMBERS AND AVERAGE PRICES OF BOARS OF EACH BREED

Breed	1914-15				1925-26				1926-27			
	No.	Average Price			No.	Average Price			No.	Average Price		
		£	s.	d.		£	s.	d.		£	s.	d.
Berkshire	10	8	0	0	15	13	5	2	17	15	9	8
Cumberland	—		—		41	12	0	11	48	12	5	6
Essex	—		—		1	25	4	0	2	12	2	6
Glos. Old Spot ..	7	7	1	0	9	16	2	11	7	12	3	5
Large Black	18	7	5	6	70	11	11	10	65	11	10	7
Large White	64	7	3	0	315	13	12	4	462	13	16	1
Lincoln Curly Coated	4	8	4	6	35	9	19	6	29	11	9	5
Middle White ..	12	6	17	0	105	13	0	9	108	12	15	5
Large White Ulster ..	—		—		6	14	16	8	5	14	17	0
Tamworth	—		—		2	14	8	6	1	14	14	0
Wessex Saddleback ..	—		—		21	12	19	7	16	12	10	11
Welsh	—		—		41	12	3	4	48	12	6	1
Long White Lop-eared	—		—		7	13	4	8	12	14	1	8
All breeds	115	£7	5	3	668	£12	19	5	820*	£13	4	8

* 844 boars were located, but grants in respect of 24 were in suspense at the end of the year.

Service Fees.—The service fees, as in previous years, varied from 2s. 6d. to 10s., and there was a remarkable increase in the number of boars serving at 5s. or 6s. In fact there appears to be a tendency, as under the Bull Scheme, to standardize the service fee at 5s.

Year	2/–	2/6	3/–	3/6	4/–	4/6	5/–	5/6
1914-15	21	62	10	5	6	—	2	—
1925-26	—	8	11	20	57	3	414	1
1926-27	—	6	11	21	57	5	543	1

Year	6/–	6/6	7/–	7/6	8/–	8/6	10/–
1914-15	—	—	—	—	—	—	—
1925-26	53	3	—	91	—	1	6
1926-27	70	4	5	91	—	1	5

Horse Breeding.—*Heavy Horses.*—Notwithstanding the continued decline in horse breeding generally, as shown by the Annual Agricultural Returns furnished to the Ministry in June, 1926, the Heavy Horse Breeding Scheme appears to be making steady progress. The figures given in the following statement suggest that the setback which resulted from the temporary withdrawal of grants for the two years ending March 31, 1923 and 1924, has been recovered. Although the number of stallions subsidized in 1926 was slightly less than in 1921, the number of mares served was appreciably greater, and it may be added that the demand for grants, which has been received by the Ministry in respect of the service season of 1927, gives promise of further progress.

HEAVY HORSE SCHEME

Year	No. of Stallions	Total No. of Mares served	Average No. of Mares served	No. of assisted nominations	Average hiring fee of Stallions	Average service fee
				£	£	£ s. d.
1914-15 ..	72	6,365	68	1,503	231	2 8 6
1915-16 ..	97	9,122	94	2,430	241	2 9 6
1916-17 ..	108	9,995	92	2,181	244	2 11 0
1917-18 ..	110	10,556	96	2,151	258	2 16 3
1918-19 ..	122	12,281	100	2,165	285	2 15 8
1919-20 ..	118	10,920	96	1,996	317	3 6 3
1920-21 ..	105	9,133	87	1,839	345	3 13 1
1921-22 ..	101	7,888	78	1,943	333	3 13 7
1924-25 ..	87	6,098	70	—*	178	2 7 0
1925-26 ..	96	7,413	77	1,723	194	2 8 4
1926-27 ..	98	8,165	83	2,171	208	2 8 6

* No grant was made by the Ministry for assisted nominations (except to the Cumberland Society) for the year 1924-25.

The above figures do not include the activities of the Cumberland and Westmorland Society, which was formed in 1915 for the purpose of issuing only assisted nominations to selected stallions. The numbers of such nominations issued by this Society since 1915 are as follows :—

Year	No. of assisted nominations	Year	No. of assisted nominations
1915-16 ..	385	1920-21 ..	254
1916-17 ..	394	1921-22 ..	255
1917-18 ..	328	1924-25 ..	121
1918-19 ..	321	1925-26 ..	197
1919-20 ..	264	1926-27 ..	220

The decline in the number of assisted nominations issued by the Society from 1919 to 1921 was due to the increase in service fees which automatically increased the value of an assisted nomination and, consequently, reduced the number available from the Ministry's grant. The Society ceased

operations after the withdrawal of the Ministry's grant, and upon its revival in 1924-25 the grant was reduced to one-half. With the subsequent extension of the Society's activities, additional grants have been given, and the result is reflected in the increase in the number of nominations issued.

While existing conditions do not suggest that Heavy Horse Breeding will assume the same importance as in the past, it is evident that more breeding is necessary in order to maintain the number of working horses at the present level. Owing to the depressed state of the Horse Breeding industry during the last few years, the number of individual owners who travel stallions has decreased. Many districts are, therefore, now dependent on stallions travelled by Societies, and it is hoped that the assistance which the Ministry gives to such Societies will encourage them to carry on and develop their good work.

Horse Breeding Act, 1918.—Although the number of stallions, licensed during the year ended October 31, 1926, continued the decline which has taken place each year since 1921, it will be noted that the rate of decrease has again slackened.

Year (ending October 31)	Number of applications for Licences	Number of Licences issued	Number of refusals
1920 ..	4,153	3,749	404
1921 ..	4,060	3,816	244
1922 ..	3,644	3,479	165
1923 ..	2,897	2,761	136
1924 ..	2,285	2,210	75
1925 ..	1,908	1,849	59
1926 ..	1,664	1,608	56

Of the 1,608 stallions licensed in 1926, 1,499 were pedigree animals, and the remaining 109 were horses that were not entered or accepted for entry in any recognized stud book.

The following tables show the number of stallions of each breed concerned that were licensed or rejected, and the number refused licences in respect of the various prescribed diseases or defects :—

NUMBER OF STALLIONS LICENSED OR REFUSED

	Pedigree		Non-Pedigree*	
Heavy	Licensed	Refused	Licensed	Refused
Shire	797	32	32	—
Clydesdale	117	3	5	—
Suffolk	139	5	—	—
Percheron	41	4	—	—
Others	—	—	22	—
Total Heavy (*see next page*)	1,094	44	59	—

NUMBER OF STALLIONS LICENSED OR REFUSED (*continued*)

	Pedigree		Non-Pedigree*	
	Licensed	Refused	Licensed	Refused
Heavy (*see previous page*)	1,094	44	59	—
Light				
Hackney	95	5	13	—
Thoroughbred	136	4	2	—
Arab	20	—	3	—
Hunter	4	—	1	—
Cleveland Bay	5	—	—	—
Yorkshire Coach	2	—	—	—
Welsh Roadster	1	—	—	—
American Trotter	—	—	2	—
Others	—	—	4	—
Ponies (including Welsh Cobs)	142	2	25	1
Totals	1,499	55	109	1

* Non-pedigree stallions are arranged as far as possible under types.

NUMBER OF STALLIONS REJECTED FOR THE PRESCRIBED DISEASES AND DEFECTS

Roaring	10	Stringhalt	2
Whistling	16	Shivering	3
Sidebone	11	General unsuitability ..	1
Cataract	4		—
Ringbone	4	Total	56
Bone spavin	5		—

Seven appeals were made against refusals of licences, and in four cases the appeals were successful.

Twelve cases of infringement of the Horse Breeding Act were reported during the year. In three cases unlicensed stallions were found to be travelling for service, and prosecutions which followed in two of these resulted in a fine being imposed in one case, while the other was dismissed on payment of costs. Seven licensed stallions were reported as travelling unaccompanied by licences, and in two cases owners failed to notify change of ownership.

Sheep.—Grants, up to a maximum of £10 for each ram provided and at the rate of 3s. 4d. per ewe served, were again made by the Ministry to a number of Societies in Wales for the encouragement and improvement of breeding of Welsh mountain sheep. Twenty-five Societies provided a total of 25 rams. The total number of ewes served was 1,471, an average of 59 per ram. The average hiring fee of the rams was £9 16s. 0d., and the average service fee 1s. 6d.

This scheme has been in operation since 1919, and the reports, which the Ministry has received, show that its operation has been uniformly successful. Welsh Mountain Sheep are an important factor in farming in many parts of Wales, and

notwithstanding the need for improving the standard of the flocks, no systematic improvement on co-operative lines appears to have been attempted until the Ministry's scheme was introduced. The scheme has effected marked improvement in several districts, and has created an interest which has led to a healthy rivalry among breeders, and to additional attractions in the form of special classes for sheep at local shows.

Milk Recording.—The figures given below show an increase in the total membership of Societies, and in the number of herds and cows recorded.

	Year*	Societies	Members	Herds	Cows
April 1 to March 31	1914–15	16	264	306	7,331
	1915–16	20	350	398	9,811
	1916–17	22	441	495	12,950
	1917–18	25	503	555	14,404
Oct. 1 to Sept. 30	1917–18	27	639	708	19,793
	1918–19	38	1,191	1,332	37,880
	1919–20	46	2,075	2,312	61,323
	1920–21	52	3,328	3,664	97,903
	1921–22	55	3,949	4,362	117,023
	1922–23	55	4,365	4,767	127,151
	1923–24	52†	4,764	5,209	138,086
	1924–25	50†	5,081	5,516	148,905
	1925–26	49†	5,174‡	5,656‡	154,322

* Before October 1, 1917, there was no uniform year for Societies.
† The decrease in the number of Societies is due to amalgamation.
‡ Including 29 members recording goat herds only.

For a year which was in some respects a difficult one for milk recording propaganda the increase shown is not unsatisfactory, especially in view of the somewhat larger number of resignations which took place during the year. Two principal causes seem to have brought the numerical progress of several Societies almost to a halt. The necessity for economy in expenditure has led many farmers to withdraw from their Societies. There is reason, however, to believe that many of them continue to record and that the practice of private recording has much increased during the last year or two. Though the resignation of members may be unfortunate from a Society's point of view, it should be borne in mind that the main object of the Scheme is achieved when farmers are converted to the practice of recording. Further discouragement was given to recording during the year under review by the somewhat low prices and the over-production of milk in some districts, with the consequent difficulty of disposing of the surplus. That these conditions should discourage recording

indicates how little in some directions the functions of milk recording are understood.

Over-production does not necessarily imply economical production, and when milk is realizing low prices it is obviously more than ever desirable that it should be produced as economically as possible. Milk recording and its allied practices of rationing and testing for butterfat are the surest means of effecting economy in milk production, and it is satisfactory to find that while the numerical progress of the Scheme may be slackening there is a growing tendency to take advantage of the advice given by the Agricultural Organizers and others on questions of rations and economy of management.

Average Yield of Recorded Herds.—Of the 154,322 cows and heifers recorded under the Scheme 81,669, *i.e.*, 53 per cent. (as compared with 51 per cent. in the previous year) were cows which had been retained for the full year. The following table compares the average yield of (1) all cows and heifers recorded, and (2) cows recorded for the full year, for each year since the uniform milk recording year was fixed.

Year Oct. 1 to Oct. 1	No. of Societies	Particulars of all cows and heifers recorded			Particulars of cows recorded for full year			
		No. of cows and heifers	Total yield	*Average yield	No. of cows	Percentage of total cows and heifers	Total yield	*Average yield
			gal.	gal.			gal.	gal.
1917–18..	27	19,793	8,426,958	426	8,775	44	5,255,923	599
1918–19..	38	37,880	16,204,941	450	17,989	47	10,543,516	579
1919–20..	46	61,323	29,344,887	479	27,266	44	17,363,347	637
1920–21..	52	97,903	48,512,380	495	48,248	49	30,892,620	640
1921–22..	55	117,023	60,463,617	517	63,318	54	41,208,073	651
1922–23..	55	127,151	67,904,224	534	68,349	54	46,956,565	687
1923–24..	52	138,086	73,963,165	535	73,338	53	50,299,884	685
1924–25..	50	148,905	76,419,498	513	77,132	51	51,695,291	*670
1925–26..	49	154,322	81,623,788	529	81,669	53	56,102,434	*687

*Before 1924-25 the average yield was calculated at the equivalent of 10½ lb. to a gallon and subsequently at 10¼ lb.

The average yield of the full-year cows was 7,098·4 lb. (687 gal.), which is the highest attained since the scheme was started.

The increased production was fairly general, only eight Societies showing a lower average than in the previous year. More interesting and instructive from the individual farmer's point of view is the increased average obtained by herds which have been recorded over a number of years. In the examples given below the improvement secured is translated into terms of cash, which suggest that in these cases, which are typical of many, milk recording has proved a sound investment.

Herd	No. of years during which records were taken	Average yield per cow in first year	Average yield per cow in last year	Increase in annual average yield per cow	No. of cows in last year of period	Cash value of increase of last year over first year at 1/- per gallon	
						Per cow	Per herd
		gal.	gal.	gal.		£ s.	£ s.
A. (Pedigree Friesian) ..	5	634	1,010	376	17	18 16	319 12
B. (Pedigree Guernsey) ..	6	579	849	270	18	13 10	243 0
C. (Pedigree Park Cattle) ..	6	479	752	273	14	13 13	191 2
D. (Mainly pedigree Shorthorn) ..	5	525	983	458	22	22 18	503 16
E. (Non-pedigree Shorthorn) ..	5	787	973	186	23	9 6	213 18
F. (Non-pedigree Shorthorn) ..	5	563	1,067	504	11	25 4	277 4
G. (Non-pedigree Shorthorn) ..	5	612	909	297	42	14 17	623 14

While the milk recording scheme covers all breeds without distinction the individual farmer or breeder is naturally more concerned with the performances of the breed in which he is particularly interested. The following analysis showing the average yield of full-year cows of each breed or type recorded under the Scheme may, therefore, be of interest.

Statement showing the total number of Cows and Heifers of each breed recorded in England and Wales during the year ended October 1, 1926, and the number and average yield of Cows of the various breeds recorded for the full year, together with the percentage of full-year Cows.

Breed or type	Total number of cows and heifers recorded	Particulars of Cows recorded for full year			
		Number	Percentage of total cows and heifers	Total yield	Average yield
				lb.	lb.
Aberdeen Angus	49	26	53·0	201,946	7,767
Ayrshire ..	1,376	624	45·3	4,605,800	7,381
Blue Albion ..	1,616	1,048	64·8	7,878,703	7,518
Devon	1,631	912	55·9	5,305,118	5,817
Dexter	337	196	58·1	891,826	4,550
Friesian.. ..	20,154	10,873	53·9	89,598,773	8,240
Galloway ..	42	6	14·2	46,542	7,757
Gloucester ..	54	28	51·8	150,396	5,371
Guernsey ..	6,227	3,040	48·8	19,269,262	6,339
Hereford ..	235	149	63·4	1,103,998	7,409
Jersey	4,640	2,253	48·5	13,869,204	6,156
Kerry	664	354	53·3	1,974,622	5,578
Lincoln Red ..	3,104	1,674	53·9	11,645,315	6,957
Longhorn ..	10	3	30·0	29,131	9,710
Park Cattle ..	101	57	56·4	410,442	7,201
Red Poll ..	4,251	2,531	59·5	17,194,766	6,794
Shorthorn ..	100,532	53,702	53·4	378,953,947	7,057
South Devon ..	2,829	1,321	46·6	8,227,435	6,228
Sussex	18	7	38·8	58,690	8,384
Welsh Black ..	1,291	690	53·4	3,942,235	5,713

Milk Record Certificates.—The number of milk record certificates issued for the year or part year ended October 1, 1926, was 206 as compared with 353 in the preceding year. This continued drop is not surprising, as a certificate is not necessary, as it was originally, as a condition of entry in the Ministry's Register of Dairy Cattle, and the charge for a certificate is, moreover, a strong deterrent to application. While these considerations have naturally tended to reduce the demand for annual record certificates, it is interesting to find that the Ministry's Certificate of Merit is becoming more appreciated. This form of certificate, which is a record of proved milk yielding and breeding qualities for a period of three consecutive years, is obviously of value, and in view of the qualifications necessary to obtain it, it is satisfactory to record an issue of 276 certificates of merit as compared with 197 in the preceding year.

Of the 276 certificates of merit issued for the period ending on October 1, 1926, 120 were in respect of cows which yielded

30,000 lb. or over during the three-year period. This number includes 56 Shorthorns, 18 Friesians, 16 Red Polls and 7 Ayrshires. The highest yield certified was 59,960¾ lb. given by a non-pedigree Shorthorn cow, while a non-pedigree Friesian cow gave 48,908½ lb. and a pedigree Shorthorn 48,035¼ lb.

Register of Dairy Cattle.—The tenth volume of the Ministry's Register of Dairy Cattle, which has been issued in respect of the milk recording year ending October 1, 1926, contains particulars of 7,500 cows. The entries consist of the highest yielding cows selected from the Annual Returns of members of the various milk recording societies, arrangements being made for the inclusion of cows of each breed. Twenty recognized breeds or types are represented in the volume, 64 per cent. being of the Shorthorn type, 18 per cent. Friesian and 4 per cent. Guernsey.

The limitation of the number of entries in the Register to 7,500 necessitates the exclusion of very many cows which reached the qualifying standard for their respective breeds. In all 15,577 qualified for entry, and whereas the lowest yield prescribed for any breed is 8,000 lb. slightly more than 7,000 of the cows entered gave 10,000 lb. or over; 67 per cent. yielded between 10,000 and 12,000 lb.; 20 per cent. between 12,000 and 14,000 lb.; and 6 per cent. between 14,000 and 20,000 lb. Twenty-four cows gave 20,000 lb. or over.

Particulars of 276 cows which were awarded certificates of merit are also included in the Volume.

The number of bulls entered in the Volume was 66 as compared with 38 in Volume 9. Of these 28 were entered in the Register for the first time. Forty-eight of the 66 bulls entered qualified under the requirement that their dams and sire's dams have given not less than the standard yield prescribed for their breed or type during a milk recording year, and 18 were entered as having two or more daughters which have given the prescribed yield.

Rationing.—Much useful work has been done by County Agricultural Organizers and the Ministry's Live Stock Officers in urging members of milk recording societies to devote more attention to the methods of feeding, and one of the most encouraging features of the year under review is the manifestly increased interest in this matter. Advice on rationing can now be readily obtained from County Agricultural Organizers whose valuable assistance is much appreciated, and it is frequently found that farmers take up recording as members

of societies or privately in order to secure the benefit of the advice of the County Organizers on food rations.

Testing for Butterfat.—From information furnished by milk recording societies, it appears that butterfat testing is making progress. During the year ended October 1, 1926, the number of samples taken and analyzed was 108,335, as compared with about 95,000 in the preceding year. Of these, about 90,000 were samples of milk from individual cows. For reasons given in last year's report, official recognition of butterfat tests has not hitherto been considered practicable. The importance of this question is fully appreciated by the Ministry and continues to receive careful consideration.

Calf and Bull Marking.—There was a substantial increase in the number of calves marked under the scheme, the number being 16,917 as compared with 15,416 in the previous year. The number of bulls marked was 81 as compared with 117. Reference has been made above to the marking of calves by Bull Societies, and although such calves are not included in the above figures the innovation is worthy of mention as illustrating the progress made in this direction.

Cost of Milk Recording.—The cost of recording varies considerably throughout the country. The average cost per cow to the member ranged from 2s. 1d. in one society to 9s. 6d. in another, while the average cost per cow to the society varied from 3s. 11d. to 11s. 2d. In the average cost of recording per cow over the whole country there was very little change from the preceding year, the cost being 4s. 4d. and 6s. 4d. to the member and society respectively as compared with 4s. 3d. and 6s. 3d. Local conditions, no doubt, are largely responsible for variations in cost, but it is highly probable that more uniformity could be attained and the cost reduced by more economical management on the part of some societies. Several societies have improved in this respect during the year, and, in view of the deterrent effect of high levies, especially at the present time, the matter is one which all societies will be well advised to keep under constant review.

Exportation of Live Stock to Countries Abroad.—There was, during the year under review, no relaxation of the prohibitions of importation passed by the various governments abroad owing to the existence of foot-and-mouth disease in this country, and the export of live stock continued, therefore, to be much restricted. Inasmuch, however, as the position has improved, it is probable that some relaxation of these pro-

hibitions may be made. The Ministry continues to supply information with regard to the regulations in force at the time in any particular country, upon inquiry by intending exporters. Particulars of the number and declared value of animals exported are published at the end of each quarter in this JOURNAL.

The following memoranda, which give detailed information concerning the Live Stock operations of the Ministry, can be obtained (single copies free of charge) on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

Leaflet 282: Scheme for Improvement of Live Stock.
Leaflet 146: The Value of Records of the Milk Yields of Cows.
No. 609/T.L.: Bull Grant Regulations.
No. 392/T.L.: Milk Recording Regulations.
No. 466/T.L.: Boar Grant Regulations.
No. 89/T.L.: Heavy Horse Regulations.

MILK RECORDING SOCIETIES

STATEMENT GIVING PARTICULARS OF FORTY-NINE MILK RECORDING SOCIETIES OPERATING DURING THE YEAR ENDED OCTOBER 1, 1926.

(*The Societies are arranged in order of total number of animals recorded.*)

Society	No. of members	*No. of herds	*Total No. of animals recorded	No. of cows recorded for full year	Average yield of cows recorded for full year
Somerset and North Dorset	288	326	9,969	5,789	7,042
Essex County ..	229	263	9,561	5,132	7,612
Hampshire	258	284	8,909	4,971	6,830
East Sussex	209	240	6,928	3,536	6,835
Norfolk	232	260	6,916	4,031	7,513
North Wilts	129	154	6,743	3,672	7,029
Berkshire	156	179	6,558	3,412	6,866
Kent	189	210	5,832	2,966	7,094
Hertfordshire ..	166	192	5,513	2,673	7,222
Dorset	94	123	5,319	3,270	6,619
Suffolk	204	221	4,921	2,572	7,463
West Sussex ..	130	154	4,754	2,419	7,133
Surrey	173	184	4,744	2,325	6,863
Oxfordshire	121	131	4,048	1,875	7,310
Leicestershire and Rutland	147	155	3,908	2,028	6,933
Warwickshire ..	155	159	3,880	2,092	7,249
South Wilts	71	91	3,829	2,432	7,672
Lancashire County ..	104	112	3,161	1,226	7,072
Carried to next page	3,055	3,438	105,493	56,421	—

* Goats are not included.

MILK RECORDING SOCIETIES (*continued*)

Society	No. of members	*No. of herds	*Total No. of animals recorded	No. of cows recorded for full year	Average yield of cows recorded for full year
Brought over from previous page ..	3,055	3,438	105,493	56,421	—
Shropshire	75	82	2,930	1,652	7,393
Staffordshire ..	98	100	2,808	1,535	7,484
Gloucestershire ..	94	104	2,662	1,398	7,208
South Devon and District	117	121	2,603	1,181	6,238
Northamptonshire ..	96	102	2,483	1,271	6,710
Yorkshire	130	138	2,475	1,236	7,134
Bristol and North Somerset	107	109	2,434	1,334	6,995
Cambridgeshire and District	86	91	2,350	1,234	7,451
Derby and District..	59	66	2,226	1,063	7,545
Cheshire County ..	62	68	2,198	1,101	7,137
Buckinghamshire ..	81	85	2,106	1,106	7,312
Worcestershire ..	87	90	1,812	929	7,364
Cumberland & North Westmorland ..	103	104	1,791	826	6,132
Nottinghamshire ..	55	58	1,695	839	7,003
East Devon	86	88	1,540	786	6,661
Bedfordshire ..	51	54	1,514	886	7,091
Denbigh & Flintshire	68	71	1,355	801	6,952
Cornwall	71	72	1,263	659	6,483
Lincolnshire	43	48	1,228	629	7,121
Peak (Derby) ..	57	57	1,169	589	7,326
United Counties ..	77	78	1,079	588	6,422
Kendal and South Westmorland ..	48	50	1,022	379	6,101
Northumberland ..	45	47	950	476	7,213
Durham County ..	32	36	923	379	7,647
Herefordshire ..	37	38	894	459	7,861
Campden Moreton & District	40	42	826	468	6,838
Monmouthshire ..	35	37	772	421	6,892
Anglesey and Carnarvonshire	64	64	751	428	5,929
Glamorgan	46	46	516	313	7,114
Montgomeryshire ..	20	21	302	183	6,696
Merionethshire ..	19	20	152	99	5,599
Totals	5,144	5,625	154,322	81,669	7,098

* Goats are not included.

* * * * * *

THE CONTROL OF LIVER ROT OF SHEEP*

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DURING the past two years, much research concerning the control of liver rot of sheep has been in progress. These recent investigations have so considerably advanced our knowledge that it is opportune to discuss briefly the results obtained and their application. Effective control measures can now be recommended and the writer puts in a plea for a systematic attempt to abolish the disease as an epidemic.

Important Features of Liver Rot Bearing upon the Problem of Control.—Sheep pick up the encysted stage of the liver fluke in grazing. In the intestine, the young flukes emerge from these cysts, make their way to the liver and enter the bile ducts of that organ. There they mature and continue a parasitic existence, laying many thousands of eggs which, passing down the ducts, reach the outer world in the droppings of the sheep. Some time after reaching water, these eggs hatch and the free-swimming form seeks a certain fresh-water snail, *Limnaea truncatula* (also, possibly, *L. pereger*), which it enters. Within the snail, development and multiplication take place until a final stage, in which the organism bores its way out, is reached. Swimming actively, this form seeks a blade of grass, or portion of another plant, on which it forms an adherent cyst. These cysts, which are about the size of a small pin's head, may form free on the surface of water. The ingestion of this encysted stage by sheep (or other suitable host) completes the life cycle. The fresh-water snails mentioned are common inhabitants of wet places, the sides of ditches, pools, etc., particularly on clay soils.

The season of the year during which sheep may become infested is generally believed to be the late summer and autumn months, but it extends into the winter in wet open seasons. The period which elapses between the picking up of the encysted stage and the development of the fluke to egg-laying maturity does not appear to have been carefully investigated hitherto. As a result of certain preliminary

* In this paper, liver rot of sheep is limited in its application to cover only disease due to infestation with *Fasciola hepatica*. Infestation by *Dicrocoelium dendriticum* appears to occur only rarely within the British Isles, and the writer has had no opportunity of studying its control.

observations, the writer believes that this phase of development occupies a period of about ten weeks. We may assume, then, for the purposes of control, that flukes picked up during the late summer will mature to the egg-laying stage early in October, and that those picked up later will have matured by April 1. Future work may necessitate a modification of this view which is simply accepted as a working hypothesis.

It should be noted that cattle and rabbits may be infested with flukes and become, therefore, distributors of eggs. Considerable numbers of cattle harbour flukes without showing marked evidence of disease. During liver rot epidemics, many rabbits die in affected areas as a result of infestation, but the writer believes that, in the great majority of cases, their death occurs before the flukes have reached the egg-laying stage. It is very probable that cattle and rabbits play a much smaller part in the distribution of eggs than do sheep.

General Principles Applicable to the Control of Liver Rot.—(1) It is obvious that sheep and cattle should be kept away from land on which they may become infested. Very often this is impossible, and the fluke must be attacked at vulnerable points in the cycle of its life history.

(2) Since the fresh-water snails, mentioned above, must be available before the liver fluke can multiply and spread, steps may be taken to destroy them.

(3) Attempts may be made to destroy the fluke within the sheep and other hosts, thus preventing the distribution of eggs and the propagation of the parasite.

It will be appreciated that any or all of these principles should be applied wherever possible. The third necessitates the use of anthelmintic drugs and success will depend on the efficiency of the system of dosage adopted. It must be realized also that such dosage must be comprehensive and not limited to any group or species in a community of infested animals. Investigations have been concerned, chiefly, with the practical application of the second and third principles mentioned above.

APPLICATION OF THE GENERAL PRINCIPLES ENUNCIATED ABOVE

(1) Avoidance of Infestation.—Since the earliest days, it has been recognized that low-lying damp land, especially on clay soils, is "dangerous" as regards fluke infestation. Undoubtedly the loss caused by liver rot has been minimized by

keeping sheep from such land. This precaution, which greatly reduces the value of so many grazings and renders others valueless for sheep, cannot, however, be widely observed. It may be possible, by means of fencing, to cut off small dangerous portions of fields which are otherwise sound. Fencing-out has been adopted with a certain degree of success, but, obviously, this is a method which can only be applied on a limited type of grazing.

(2) **Destruction of the Snails.**—(*a*) *The Value of Certain Birds.*—Certain birds, ducks and lapwings in particular, make fresh-water snails part of their diet. Where practicable, flocks of ducks may be given free range over damp pasture and the lapwing should certainly be protected.

(*b*) *The Value of Drainage.*—Efficient drainage has been recognized as, perhaps, the best method of reducing the number of snails on any pasture, and it will be generally agreed that drainage is the greatest need of large areas of land in these islands. Certainly the prosecution of many drainage schemes is costly and each field presents its own particular difficulties of levels and outflow, but, quite apart from the opening up of new drains, proper attention to existing waterways can considerably increase the value of many pastures and, incidentally, reduce the number of snails on the adjoining land. On many occasions, the flooding of an area of land in the vicinity of a partially-blocked ditch or drain, or a ditch whose sides have been broken down, has been responsible for the infestation of many sheep. If ditches are cut with straight or steep edges, and thereafter kept clear and the edges attended to, a reduction of the number of snails within that area may readily be effected.

(*c*) *The Use of Copper Sulphate.*—In the search for a substance which would destroy the snail, without spoiling the pasture or rendering it dangerous to stock, lime, salt and other materials were given a trial. None of these proved of value, but the discovery that very dilute solutions of copper sulphate are particularly inimical to fresh-water snails opened up new possibilities. At the suggestion of Daubney, Walton made his first tests with copper sulphate, under field conditions, in 1921, continued his work in 1923 and, in conjunction with Jones, further extended it during 1925.

These researches have convincingly shown that the proper application of copper sulphate is a cheap and practical method of wiping out the snail population of the area covered. The sulphate has been employed in three different manners,

Solutions may be sprayed over the area by means of a machine; either one of the large horse-drawn implements used to spray potato crops or to destroy charlock, or by one of the "knapsack" type employed by horticulturists. The strength of solution selected depends on the nature of the area to be sprayed. On fairly dry land, ½ per cent. solution should be liberally applied that the whole area may be thoroughly wetted. On partially flooded land solutions of 1 per cent. or 2 per cent. should be used to allow for the further dilution which must occur before contact with the snail is effected. A smaller quantity per acre would suffice in this case. The amount of solution must also vary with the degree of protection afforded by herbage, being greater where the grass is long. Walton found amounts varying from 80 to 137 gallons per acre sufficient. Sprays may be used under a variety of conditions but the rather general absence, in affected districts, of suitable apparatus limits their use.

As a dust, one part of finely-ground copper sulphate to four parts of china clay, an efficient dressing may be applied to small areas—the sides of ditches, etc.

The broadcast sowing of finely-ground copper sulphate mixed with dry sand appears to be an admirable mode of application. Walton and Jones found mixtures of four and of eight parts of sand to one of the sulphate efficient when sown at the rate of 1¼ and 2¼ cwt. per acre respectively. These broadcast mixtures appear to be applicable to all types of "danger" spots and areas.

Copper sulphate dressings may be applied at any season but, very probably, their use during the month of June will be attended with greatest advantage. After an application, a careful watch should be maintained to determine whether snails have re-entered the area by migration or by carriage in water. Norris has shown that sheep may be allowed to graze sprayed pasture after seven days. Following a dust or broadcast application, it appears advisable to keep stock from the treated land until rain has fallen.

Despite the fact that more than four years have elapsed since the value of copper sulphate was demonstrated, it cannot be said that this method is widely used to control the ravages of liver rot. It would appear that one reason for its partial failure to meet the case is that, at the season of the year when the use of copper sulphate is attended with most advantage, the stimulus of being face to face with the disease is absent. Few farmers can be made to consider and apply active control

measures during the summer months. As the season during which they frequently experience loss approaches, their thoughts may more easily be directed to the control of the disease.

(3) Destruction of the Liver Fluke Within the Sheep and Other Mammal Hosts.—(*a*) *The Use of Carbon Tetrachloride in Sheep.*—Investigations directed towards the finding of a drug, which might be used in the destruction of the liver fluke infesting sheep, received relatively little attention, so far as these Islands are concerned, until the severe outbreak of 1920–21. Then a proprietary preparation of male fern named "Danistol" was introduced from abroad. Sold in carefully-regulated doses ready for administration it gained favour as an efficient remedy.

Liquid extract of male fern B.P. had been little used within the British Isles until its value was investigated during 1924–25 by the writer and by Norris. These researches showed that the drug could be employed provided reasonable care was exercised. During its extensive use that season, it was evident that certain factors affecting its toxicity were not properly understood and required investigation. Further work indicated that one factor was the age of the extract. Freshly prepared material is much more dangerous than old.

Experiments conducted at this centre during 1925–26 showed that *pure* carbon tetrachloride was highly efficient and very safe. The efficiency of dosage with 1 c.c. was established. and sheep, in the advanced stages of liver rot, tolerated perfectly doses as large as 50 c.c. While this investigation was in progress, Norris, in Ireland, was working along similar lines. He did not have opportunity to pursue his research very far but obtained evidence of the efficiency and safety of the drug.

It must be noted that the efficiency of these drugs is limited, for it has been shown that they only destroy those flukes which are approaching maturity to the egg-laying stage, and those actually mature. Certain less mature forms escape. Thus, sheep which are infested with flukes in various stages of development cease to pass eggs following dosage but, at the earliest, four weeks after treatment, eggs reappear in their droppings.

We must compare the apparent value of these three preparations—"Danistol," extract of male fern, and carbon tetrachloride—particularly from the points of view of efficiency, safety and economy, and select the most suitable. All have demonstrated high value in destroying mature, and almost mature, flukes, and each has failed, in a degree at least

approximately equal, to destroy less mature forms. "Danistol" is acknowledged to be "safe." Extract of male fern has a safety factor too small to permit that degree of error which is liable to creep in when large numbers are treated. The range of safety when carbon tetrachloride is employed is so wide that this drug may be used with confidence. The cost of "Danistol" places it at a serious disadvantage and discourages considerably its use to "treat," let alone to "control," liver rot of sheep. The cost of extract of male fern is much smaller, but considerably greater than that of carbon tetrachloride, which involved the expenditure of but one or two pence per head each treatment. It may be added that the employment of carbon tetrachloride necessitates dosage on one morning only, whereas each of the other drugs must be administered on two consecutive days.

It is evident that carbon tetrachloride is by far the most valuable drug. Eminently suitable for the dosage of large numbers of sheep at intervals, it provides a means to kill all the flukes infesting even large flocks before they reach maturity to the egg-laying stage, thus preventing the distribution of eggs and the spread of liver rot.

The administration recommended is a single dose of 1 c.c. of *pure* carbon tetrachloride in soft gelatine capsule. It is the writer's practice to prepare the sheep for dosage by removing them from pasture in the late afternoon of the previous day. This preliminary period of starvation may, however, be omitted, as it does not appear to affect the efficiency of the administration. In either case the sheep may be sent to pasture immediately after the capsule has been given. This mode of treatment has been found efficient for sheep up to 140 lb. weight. and it is probable that its range of efficiency is much greater. Since this dosage destroys only those flukes which are mature or approaching maturity, it is necessary to redose after a period. Then those flukes which previously escaped, and have in the interval reached a stage of development at which they may be assailed by the drug, will be destroyed. The evidence at present available indicates that this interval should be one of about four weeks. Dosage of a flock at monthly intervals during the season when flukes may mature would, therefore, prevent the deposit of eggs on the pasture.

The extent to which this drug is employed in future years to prevent the outbreak of epidemics of liver rot must depend upon the realization by farmers in those districts which are menaced by the disease of the feasibility of materially reducing

by one simple measure their current loss from the disease and at the same time lessening its future incidence.

It must be realized that each administration to an affected sheep of an efficient drug is, in itself, a general control measure apart altogether from the treatment aspect. Such administration decreases the number of eggs which are distributed, decreases the opportunity for snail infestation and, therefore, the chance of stock becoming infested with flukes. In addition to those members of a flock which show evidence of infestation, it must be remembered that many others, if not all, are likely to be harbouring flukes and distributing eggs. *These considerations make it obvious that mass treatment (dosage of whole flocks, not of individual sheep) should be adopted and that such treatment is a means of control. The tendency to dose only the obviously affected sheep of a flock should be combated by pointing out the great advantages of mass treatment. The low cost of carbon tetrachloride makes this mass mode of treatment very sound economically.*

The actual system of dosage adopted must depend upon several conditions relating to the incidence of the disease and the opportunities for the collection of sheep on each individual farm. On the great majority of those farms which regularly have small losses, and frequently large ones, it would be advisable and easily practicable to dose every sheep at monthly intervals each year, commencing at the beginning of October and ending early in April. Under such a system the farmer might be assured that his loss from liver rot (other than from "acute" cases, which must soon disappear where such a system is practised) would be cut out. Each year, fewer and fewer snails would have opportunity to become propagators of the disease. He might well look forward to the time when dosage at such regular intervals, at least following normal summers, would be unnecessary.

Following wet summer seasons, dosage at monthly intervals should always be carried out on farms which suffer any loss from liver rot. There may be seriously menaced farms on which difficulties of collection or other considerations make it reasonable to vary the system after normal seasons to dosage at intervals of two months. On less seriously affected farms, it might be reduced to dosage on two occasions, probably once early in December and again in March.

When the existence of liver rot is detected in a flock, every member should be dosed at once, and this treatment repeated at monthly intervals until the whole of the original infestation

has certainly been cleared. If, after diagnosis, opportunity for infestation still exists, the monthly administrations should be continued until April.

(*b*) *The Use of Drugs in Other Animals.*—The study of the value of drugs in the destruction of liver flukes infesting cattle has not reached the stage which will permit the recommendation of systems of dosage comparable with those recommended for sheep. Norris found certain doses of male fern of value, and "Danistol," given in the doses recommended by the manufacturers, also appears an efficient remedy. Carbon tetrachloride appears to be rather a dangerous drug for cattle and cannot, at present, be recommended.

The prevention of the scattering of eggs by infested rabbits must be attempted along different lines. We cannot induce them to come to a fold for periodic dosage! Ruthless destruction must be advised and should be practised.

Summary.—From the earliest times, disastrous epidemics of liver rot, such as those of 1879–80, 1920–21, and 1924–25, have caused widespread and serious loss to British flockmasters. In many districts, loss from this disease occurs even in normal seasons, and even though the *proportion* of sheep affected may not be large the *total annual loss to the nation* is serious.

Although there are still gaps in our knowledge, it is now possible to recommend satisfactory measures, not only for the treatment of affected sheep, but also for the prevention of infestation and for the control of the disease, which if generally adopted would remove the pest from the list of serious menaces. These recommendations are discussed in the foregoing pages and may be summarized as follows:—

(1) Keep sheep from land which is, or is likely to be, infested with the snails which act as the intermediate host of the common liver fluke.
(2) Drain wet land and open up ditches, keeping their sides as clean and vertical as possible.
(3) Protect such birds as the lapwing.
(4) Dress snail-infested land with copper sulphate.
(5) Administer carbon tetrachloride to sheep under a system which will prevent loss from the disease and also diminish or even prevent the distribution of eggs of the liver fluke.
(6) Keep down rabbits and have infested cattle treated.

Particular consideration has been given to two of these recommendations, the fourth and fifth stated above. Carbon

tetrachloride must not be regarded simply as a drug of value in the treatment of sheep obviously affected with liver rot. It has a much higher value, and should be employed to reduce or eliminate general infestation, both current and future. It is now the duty of all interested to aid the application of the measures, recommended by those engaged in the study of the control of this disease, that the disastrous results which must, otherwise, follow in the wake of future wet summer and autumn seasons may be avoided.

Postscript.—Since the above was written, observations on the use of carbon tetrachloride in the "treatment" of some 20,000 sheep, located in many counties in these Islands, have been made and reported to the writer. *The dosage recommended* (1 *c.c. of carbon tetrachloride*) *has caused the death of sheep in certain flocks fed on artificial food or folded on special crops.* Excellent results have been obtained with sheep grazing natural pasture, and the administration of very large doses to such sheep has produced only transient effects. Until further investigation has explained this remarkable difference it is advisable to dose only a few representative members of the flock, particularly if not on free range, in the first place. Should these subjects show no illness, dosage of the whole flock may be undertaken with safety. If, however, the administration has caused serious illness in any of these sheep, a preparation of male fern should be employed.

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EMPIRE MARKETING BOARD ADVERTISEMENTS:
POSITION OF HOME PRODUCE

THE advertisements issued by the Empire Marketing Board are attracting considerable attention. The general policy of the Board in this matter is to sensitize public opinion in favour of the purchase of Empire foodstuffs, first of home origin, when supplies are available, and then from overseas. Following representations made by the Ministry in regard to the direct advertisement of home products, five of the nine advertisements in the series inserted by the Board in leading popular newspapers during the months of June and July were devoted exclusively to home products; three dealing with milk and dairy products are here reproduced. It will be seen that Great Britain is now receiving an appreciable share of attention in this branch of the Board's activities.

For obvious reasons, a particular brand of any commodity cannot be advertised from Government funds unless it has national status and significance. The Ministry, after consultation with the National Farmers' Union, has secured the sanction of the Board to the principle that where an organization is open for membership to all producers of the commodity concerned and exercises an efficient measure of control over grading, packing and marking, it is proper to make mention of its brand or trademark in appropriate advertisements issued by the Empire Marketing Board. The British Glasshouse Produce Marketing Association and the Cheshire Cheese Federation fulfil these conditions, and their trademarks are specifically mentioned in two of the advertisements referred to.

Other special steps on behalf of home produce include the release of a very large coloured poster, of a simple and direct character, in favour of English soft fruits and salads; other posters are in course of preparation.

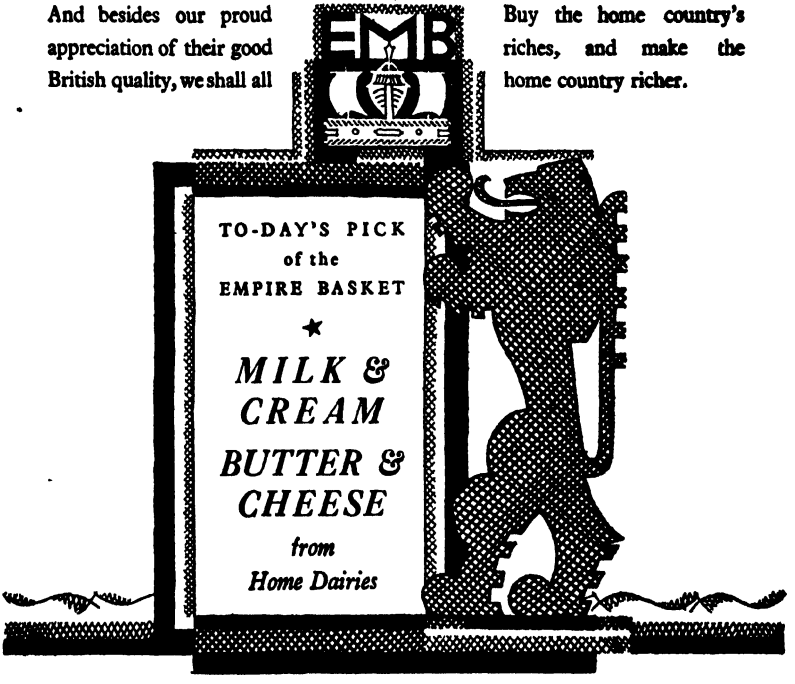
Within recent years, advertising has become a tremendous force in selling. Indeed, it is said in the business world that he who advertises succeeds; he who does not is advertised by the Official Receiver. Looking away from the individual, the task before British producers, as a whole, is clearly that of directing active demand to British produce in the British market. The spur of advertising cannot, however, give best results, and may even be ineffective, unless applied to the sale of standardized and branded goods. This has been duly realized by producers of glasshouse produce and of Cheshire cheese; it is for home producers generally to devise ways and means of following the lead thus given.

FROM THE HOME FARMS

"Home-grown," "home-raised," "from the home farms"—there is no country in the world in which these phrases carry so strong and immediate a suggestion of high quality as in our own. And rightly so. What could be fresher or richer or cleaner than the butter and eggs, the milk and cheese and bacon that come to us from the farmlands of these islands, out of cool, clean dairies anywhere from Kent to County Derry, from Cornwall to Caithness?

And besides our proud appreciation of their good British quality, we shall all of us be showing sound business common-sense if we give a thought to the story behind them. For farming is still our biggest industry, and by many centuries our oldest. Seven acres out of every ten in this Kingdom are farmlands; and on these acres far more than a million people earn their living by feeding us.

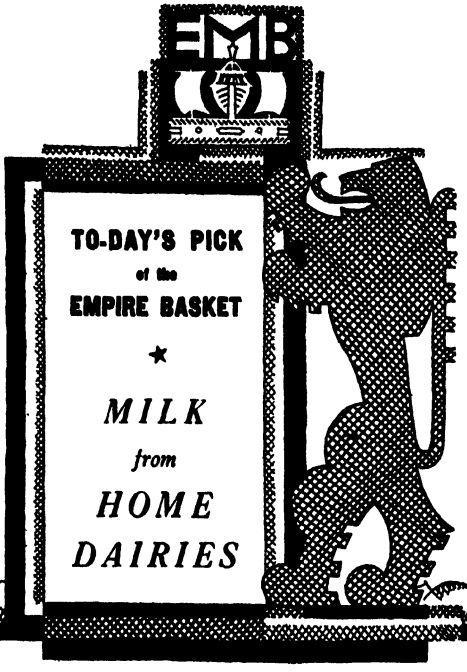
Ask for the food grown by your home folk. Enjoy the true British goodness of home-raised dairy produce. Buy the home country's riches, and make the home country richer.



BUY EMPIRE PRODUCE

from Home and Overseas

ISSUED BY THE EMPIRE MARKETING BOARD



Give the family more milk and it will be just as good as giving them more sunshine. Among all the different kinds of food—meat, fruit, vegetables, bread—milk stands alone and by itself—the one perfect food. It contains, perfectly blended and balanced, something of everything that is needed for bodily warmth and weight and strength and growth.

Now, in the height of summer, all over Great Britain, the cows are out on the pastures, cropping the sweetest, tenderest grass that grows anywhere on earth. British milk, the richest in the world, is at its best.

Drink more Milk

BUY EMPIRE PRODUCE

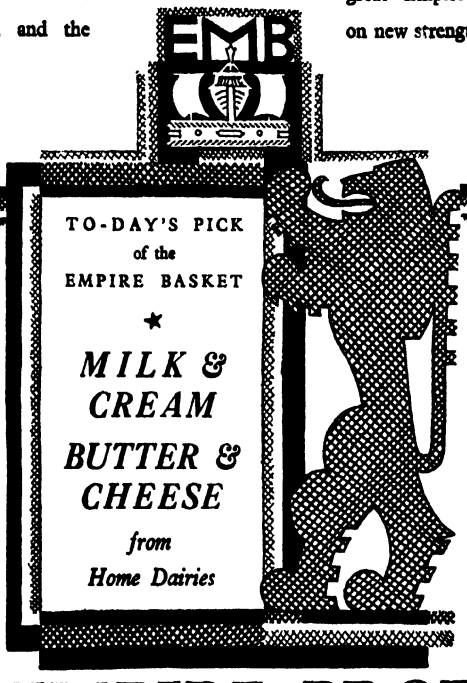
from Home and Overseas

ISSUED BY THE EMPIRE MARKETING BOARD

D 3

THE MEN TALK AND TALK, BUT—

When Mrs. John Bull goes out to fill the larder, she carries in her purse a power that sets men working for her all over the world. There are ten millions of Mrs. John Bull—and because she must buy food for her family, farmers till the soil of a hundred countries, ships move in their thousands, wheels in their millions turn. She stands at the counter, and the power in her purse begins to work; for the farmers dare not grow the food, nor the ships carry it, unless she—and the ten millions like her—will buy it. "No," she says—and somewhere an industry falters. "Yes," she says—and rich fields are turned by the plough, new factories tower into the sky. "Empire, please!" she says—and a great Empire takes on new strength.



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A CENSUS OF AN ACRE OF ROOTS

THE RELATION OF REGULARITY AND DENSITY OF PLANTS TO YIELD PER ACRE

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Introduction.—It has always been recognized that the yield of any particular crop depends to a certain extent on the density and regularity of the plants on the ground. Thus, the inspection of fields of wheat in the spring may lead farmers to express the opinion that the crop in one case is too thin, in another too thick and, in still another, too patchy; and that the harvest results will be proportionately affected. In extreme cases, it may be decided that the prospects do not justify leaving the crop till harvest, and it is accordingly ploughed up. Such conclusions, whether with cereal or root crops, are arrived at as the result of experience, but it must be admitted that actual yields do not always confirm earlier pronouncements. There are, however, degrees of plant density, and of variation in density from place to place, which cannot be appraised by the eye; such differences are either unnoticed or taken for granted. The extent and effect of these have recently been determined by Engledow in the case of the wheat crop, and the principles on which these investigations were based are equally applicable to other crops.

With roots a great deal of interest has centred round the question of their most profitable spacing in the field. Seed rate, distance between rows, and interval between plant and plant in the row, have proved to be of great practical importance. It is generally recognized that with roots, as with corn and other crops, the average size of a single plant becomes less as the number of plants per acre is increased. Thus, to get the maximum possible yield from an acre, the plants must be so spaced as to give the most favourable combination of root size and number of plants to the acre. General discussion of this subject has naturally been in terms of "averages." To say, however, that the average weight of a beet for a ten-acre field is 1½ lb. is to say very little about the actual state of affairs in the crop. Altogether, apart from distance between rows and plants and average size of a single root, there is a separate "spacing" problem of immediate practical interest.

This problem may be grasped without difficulty by walking up one of the rows in a field of roots at any time between

singling and harvest. The row may be roughly spaced out into equal lengths of about a yard by placing a walking-stick on the ground at a number of places and counting the number of roots on each of these equal lengths. In the first yard, four beets may be found, in the next, two ; in the rest, five, and so on. Occasionally there will be found a yard-length with no plants at all. This may be where the horse hoe ran out and cut away the plants or where there were blanks from the start due to irregular seeding. Such a state of affairs leads one to ask what is the effect of such irregularities on the yield per acre. On the average, will a yard with five plants yield more than one with three plants or one with four plants ? If we could grow beet or mangold crops with plants absolutely regularly arranged at two to the yard, or three or four, etc., this question might soon be answered. But, in practice, rigid regularity is never attained. There are always some places where the plants stand unusually thick, always some which are unusually thin, and always some blanks. What we require to know is the relative proportions of the thick, thin, and empty places in a typical field crop.

To appreciate these considerations fully it is essential to think of a field crop as made up of a vast number of small lengths, say yard-lengths, of rows. With plants in rows at 22 in. apart, and a cost of, say, £20 to be borne in growing an acre of sugar beet, there will be a charge of approximately one halfpenny to be debited against each yard-length. An acre of such rows may be looked on as made up of several thousand separate yard-lengths and the final result, in yield per acre, is the sum of the weights obtained from each of these units. On the one hand, the expenditure per unit is the same, on the other, the return per unit may show considerable variation. It is, therefore, desirable to know how many of the component lengths give the fullest possible crop, how many give no returns, and so on.

Sugar Beet.—The experiment to be described was made on a typical field of sugar beet at the Herts Institute in 1926. The soil shows considerable variation over the field and consists of veins of gravel, loam and clay loam which run across the rows. The ground was subsoiled, dunged and a complete dressing of artificials applied before seeding. Seed was sown on April 22 at the rate of 20 lb. per acre on the flat ; the rows were 22 in. apart; the crop yielded just under 12 tons of washed beet per acre.

For a perfect test of the matter under discussion it would be necessary to divide a whole area into yard-lengths of row,

count the plants on every yard, and finally weigh the produce from every yard. This very big task may be reduced by drawing "sample lengths" in an approved way. Such a sampling procedure has been employed on crops of wheat* and barley,† and was adopted in the case of the beet crop under investigation. Counting was carried out before singling, after singling, and at harvest. The counts give a measure of the "plant population" of the crop much as, when a "census" is taken, the distribution of the population of the country is determined.

The Plants before Singling.—As sown, the plants stand very close and it was necessary to count them on sample lengths of one foot of row. For the whole area, the average number of plants per foot was twelve, *i.e.*, the average spacing was one plant to every inch. This average value, however, does not disclose two interesting facts brought out by the counted samples. The average thickness of the plant was by no means the same for different rows. Thus on one row there was an average of eight and a-half plants per foot, on another fourteen plants. From what is known of common drill defects, it may probably be assumed that the difference was brought about by two spouts of the drill distributing seeds at very different rates. Where, as in sugar beet, regularity of plant is very important, the need for an improved drill deserves attention.

More important than average differences between two rows was the irregularity of the plant from point to point of the field. On some one-foot lengths there were two seedling plants, on others twenty, on others six, and so on. By aggregating all sample foot-lengths containing the same number of plants we may perceive what proportion of the whole area carried plants at the rate of two per foot, or six per foot, or thirteen per foot, and so on. It will be realized that all the lengths with, say, seven plants per foot were not situated close together but scattered over the field.

The "make-up" of the area before singling was in round terms as follows :—

	Plants per ft.
On an aggregate of one-fifth of the area there were from	0 to 6
" " " " "	7 to 10
" " " " "	11 to 14
" " " " "	15 to 20
" " " " "	21 to 49

* Engledow, F. L.: "A Census of an Acre of Corn," *Jour. of Agric. Science*, Vol. XVI., 1926.

† "A Census of an Acre of Barley," *Jour. R.A.S.E.*, 1927.

Thus a " plant " of beet, pronounced eminently satisfactory from the farmer's point of view, proved, on examination, to be extremely irregular. Similar results have been obtained with corn crops, irregularity in seeding being largely responsible in each case. Imperfections in the drill, in conjunction with unevenness in the seed bed, are doubtless the two main causal factors. Without attaching special importance to the figures, we may conclude that this field of beet, though presenting a pleasing appearance to the "practical" man, had in reality a very irregular distribution of plants. Observations suggest that beet crops in general are no less irregular.

After Singling and Horse Hoeing.—At this stage, the length of row sampled was 9 feet, and the figures to be given were based on 200 such samples. In no crop should the final regularity of the plants be greater than in sugar beet, for great care is exercised at all the stages, including singling.

For the whole area there was an average of 7·7 plants per 9 feet, *i.e.*, an average spacing of 14 inches between plant and plant. As before, two important kinds of irregularity were found. For one row of plants the average spacing between plant and plant was 12·8 inches ; for another row it was 15·6 inches, and so on. This difference must probably be set down to the difference in judgment of two men engaged in singling. It is significantly great, and suggests the need for precision in singling. Presenting the area in five roughly equal aggregates as before, it may be said that the following distances from plant to plant were about equally common over the whole area :—

From 54 to 18 inches ; 15½ inches ; 13½ inches ; 12 inches ; from 11 to 8 inches.

The singled crop was thus decidedly irregular. To decide how far horse hoeings were responsible for gaps and irregularities, separate counts would have to be made after each hoeing, and this will be done in future investigations. It is interesting to note that the " doubles " (two plants at one point) amounted to 10 per cent. of the total number of plants. This statistical result deserves special mention as more than ordinary care was taken in singling, and farmer visitors commented most favourably on the success attained in this respect. Apparently a much higher standard of efficiency could, with advantage, be aimed at.

At Harvest.—As the season advanced, the crop presented a very attractive appearance, although one could not but notice the spectacular display made by a number of roots

which had run to seed. The counts, however, proved that appearances were deceptive as only 3 per cent. of the roots had bolted.

The number of roots actually lifted averaged 7·5 per 9 foot length—a very small reduction on the number present after the last horse hoeings. At individual points on the field the number varied from 2 up to 11 per 9 foot length. For simplicity we may group the number from 2 to 11 in pairs, and consider what proportion of the field carried 2 or 3 plants per 9 foot lengths, what proportion 4 or 5, and so on; and, in addition, the average size of the beet and the rate of yield for these separate proportions of the whole area. Table I presents the facts.

TABLE I.—SUGAR BEET

Number of plants per 9 ft. length	Approximate distance from plant to plant	Aggregated proportion of field	Average weight of a root (lb.)	Equivalent yield per acre (tons)
2–3	43 in.	2 per cent.	2·6	8·6
4–5	24 ,,	10 ,,	2·1	11·5
6–7	16 ,,	28½ ,,	1·9	14·6
8–9	12½ ,,	49 ,,	1·5	15·1
10–11	10 ,,	10½ ,,	1·4	16·1

On these figures, the average yield for the whole area is 14·6 tons and the average weight of a single beet is 1·65 lb. The yield as determined by weighing 16 plots, each one-twentieth acre, straight off the field proved to be 16·4 tons per acre. The difference between the two yields is doubtless due in large measure to the fact that the roots from the "sample" lengths were partially cleaned before being weighed.

No serious attention can be paid to yields at the rate of 8·6 tons from 2 per cent. of the area and 16·1 tons from 10½ per cent. of the area, as these represent small proportions of the whole area. It may, however, be suggestive that the yield per acre rose rapidly up to a certain density of the plants on the ground, and thereafter very slowly. On this supposition, only 12 per cent. of the area, namely, that portion with from 2-5 plants per 9 foot length, was substantially less productive than it should have been through lack of plants.

From the results obtained in this investigation there is one general inference which is justifiable. As the distance between plant and plant diminishes, the average weight of a single beet also grows less; but the number of beets per acre naturally increases. As the figures show, there

is a steady increase in rate of yield with lessening distance from plant to plant. This is the fact of immediate practical importance. It suggests that in this crop of beet—and possibly in many others—a bigger yield might have been obtained by ensuring more plants per acre. With plants uniformly at 12½ in. apart over an acre, the yield would have been 15·1 tons instead of 14·6 tons. The difference—half a ton—is not to be despised in a valuable crop like sugar beet. Moreover, most growers would probably consider 12½ in. unduly far apart for beets. The figures suggest that with plants uniformly at 9 in. or even 10 in. a yet greater increase in yield might result.

Probably also, had a shorter length been used from which to take the samples, *i.e.*, less than 9 ft., it would have been found that the gaps and irregularities were greater than the numbers given suggest. It is broadly true that small and mid-sized roots have higher sugar percentage than the larger ones. To illustrate this point three samples of roots, 50 in each, were sorted out according to size and analysed with the following results. The analyses were kindly made by the Rothamsted Experimental Station.

Average Weight of Roots	Percentage of Sugar
3 lb.	18·0
2 lb.	18·7
1 lb.	19·1

Thus, it seems possible that the closer spacings may not only secure a heavier crop but also a higher percentage of sugar.

With rows 22 in. apart, a distance of 9 in.-10 in. from plant to plant would probably be regarded as satisfactory by most growers. This investigation suggests, however, that in practice the desired 9 or 10 in. is considerably exceeded, with consequent reduction in yield. In considering the spacing of beet, and, indeed, of all field crops, it is not only important to think in terms of averages, but also in terms of the many short lengths of plant row by which a field is made up. This mode of thought is particularly necessary in trying to ascertain how seed-bed preparation, sowing, singling, and hoeing may be so governed as to populate an acre evenly with that number of roots which will ensure the maximum monetary return.

Mangold and Marrow-Stem Kale.—A similar investigation was made on a piece of mangolds, adjoining the beet described above and similarly treated and manured. The rows were again 22 in. apart, but the rate of seeding was 8 lb. per acre. Before singling, the average number of plants per foot length

was found to be 4·6 compared with 12 in the beet crop. On an approximately equal (one-fifth) part of the area, the following numbers of seedling plants were found :—

0-1 ; 2-3 ; 4-5 ; 6-8 ; 9-21.

It is apparent that, on at least two-fifths of the area, the "plant" was very thin (not more than three plants per foot).

After singling and hoeing, irregularities were found corresponding to those described for beet. In the case of the beet about 50 per cent. of the area had roots at the rate of 8-9 per 9 foot of row, while the corresponding figure for mangolds was 6 to 7. The average distance at harvest between mangold plants was 16 in. How far the heavier seeding of the beet contributed to the greater number of beet plants per acre, compared with mangolds, is a matter for further investigation. It is possible that the present-day stimulus to make the best of the sugar beet crop may throw fresh light on long-standing practices in the culture of mangolds.

The state of affairs at harvest will be appreciated from Table II, which may be understood from the explanation given above for Table I. Similarly, Table III gives the results at harvest from marrow-stem kale in the same field, but sown on ridges 27 in. apart and singled with less precision.

TABLE II.—MANGOLDS

Number of plants per 9 ft. length	Approximate distance from plant to plant	Aggregated proportion of field	Average weight of a root (lb.)	Equivalent yield per acre (tons)
Under 5	(say) 23 in.	25 per cent.	4·2	22·7
6	18 ,,	23½ ,,	3·4	24·0
7	15½ ,,	24 ,,	3·3	27·2
8	13½ ,,	16 ,,	3·0	28·3
9–11	11 ,,	11½ ,,	2·6	29·8

TABLE III.—MARROW-STEM KALE

Number of plants per 9 ft. length	Approximate distance from plant to plant	Aggregated proportion of field	Average weight of stem and leaf (lb.)	Equivalent yield per acre (tons)
Under 5	25 in.	20 per cent.	3·3	13½
6–7	17 ,,	30 ,,	3·41	21
8–9	13 ,,	30 ,,	2·93	24
10–11	10½ ,,	18 ,,	2·58	26
12–14	8 ,,	2 ,,		

The yield for mangolds and marrow-stem kale, calculated from these figures, is 25·7 tons and 21½ tons respectively. The whole of the mangolds and kale from a measured area (about two acres of each) were weighed as they were clamped or carted to the stock, and these weights indicated a yield of 27 tons per acre for mangolds and 21 tons per acre for the kale. Reasoning in the manner adopted for the beet figures, it may be inferred that, with the plants uniformly at 11-12 in. apart, and with no gaps in the rows, the yield of both crops might have been raised by about five tons per acre.

In viewing the results of any agricultural experiment, an important reservation must be made. On a different soil and in a different season, the results also might have been different. But our concern here is not the detail of the actual figures. There are two essential points of interest. First, that in root crops grown with care in the customary manner, the plant is highly irregular. Then, as a consequence of this, the actual yield falls significantly below the maximum possible for the land and the year. Published results from investigations on fields of corn reinforce these contentions in principle. It would appear from the results described that a full regular population of plants at a suitable spacing interval is worthy of special effort in fields of beet, mangolds, and marrow-stem kale.

For help and guidance in presenting the above results, the authors wish to place on record their most grateful thanks to Mr. F. L. Engledow, of the School of Agriculture, Cambridge.

* * * * * *

OBSERVATIONS ON SUBTERRANEAN CLOVER

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SUBTERRANEAN clover (*Trifolium subterraneum*) has, during the past decade, become an important plant in the economy of Australian grassland farming: its culture has been the subject of numerous observations, and a considerable amount of literature, having an important practical bearing thereon, has recently been published. Since 1920, its behaviour has been under continuous study at the Welsh Plant Breeding Station, where it has, in many ways, proved to be a plant of great interest.

The present paper is divided into two distinct parts: the first reviews in a general way some of the more important

Australian and other literature dealing with the agronomic culture of the clover; the second deals with results obtained at the Plant Breeding Station in the course of the last two years. The behaviour of this species during the earlier trials, *viz.*, those of 1920-24, has already been reported upon by Stapledon and others (11, 15, 16).*

Description of the Plant.—Subterranean clover is a prostrate, softly hairy annual. The leaf has three heart-shaped leaflets and is on a fairly long stalk, the leaflets themselves being almost sessile. The two stipules at the base of each leaf stalk are roughly ovate with a short blunt tip. Both leaves and stipules are often flecked with red.

The flowers are white or pinkish, there being from 3-5 flowers in the head; each fertile flower gives rise to a single seeded pod. The flower stalks arise from the junction of stem and leaf, and at flowering time are shorter than the petioles, bearing individual flowers. After fertilization, however, they lengthen and become positively geotropic, turning down into the surface soil; it is this characteristic burying of the seed which has given rise to the name subterranean clover. Fibrous outgrowths are at this time developed at the base of the calyx and serve as "anchors" for the seed head, probably also assisting in pulling the head into the soil.

A single plant of subterranean clover is, under good conditions capable of spreading along the ground in all directions, producing a dense mat of leafage covering a circle 3-4 ft. in diameter, whilst individual runners may in extreme cases attain to a length of 6 ft. Under sward conditions the plants are normally smaller, but are invariably dense about the centre and flower most freely along the margin of the circle. The runners seldom, if ever, strike root at the nodes as in the case of white clover.

PART I

Review of Literature.—Subterranean clover is according to Stokes (12) of European or of South Asiatic origin. It is said to grow wild as a roadside plant in many parts of Europe, and in Britain is fairly widespread, but by no means abundant, occurring on many thin dry soils and on poor swards. The British variety seems to be a smaller and less vigorous plant than that grown from Australian seed, although it is not known how far this may be due to a difference in strain, and how far to general ecological factors such as soil and manurial treatments. The Australian variety seems to have been

* Numbers refer to bibliography at end of the article.

originally derived from Europe, having been imported into the Commonwealth as an impurity in agricultural seeds. So far as is known the introduction took place during the latter part of the nineteenth century, being recorded in Victoria as a naturalized alien in 1887-88.* At first the plant was considered useful only as a suppressor of undesirable annuals, but during more recent years it has become better known and is now regarded as an important pasture plant. It is widely grown on the main coastal vegetation belt of Western Australia, South Australia, Tasmania, Victoria, and New South Wales. Deem (4) has reported that he did not find the clover growing in New South Wales or in Queensland, but its culture has already been begun in the former country, as is evidenced by the writings of Whittet (14).

Agricultural Value.—Subterranean clover is claimed to be a most valuable plant in Australia on almost every soil type where the annual rainfall is above 20 inches. It attains its greatest relative value, however, on second-class land and on hilly or stony ground ; Mullett (7) expresses the view that on first-class land it may oust both alsike and white clovers, species that he considers superior to it. Subterranean clover yields abundant and palatable pasturage, and according to Brunning (3) produces hay of a valuable kind. Palatable to both cattle and sheep in the green succulent state, Deem (4) and Brunning (3) claim that stock will eat and thrive on the old stems and unburied seed heads after the leafage has died down.

Much of the Australian literature emphasizes the weed-suppressing capacity of the clover, as well as its ground-holding power once it has firmly established itself, Quinlan, quoted by Brunning (3), considering that once established on some soil types its eradication is difficult if not impossible.†

Many writers, including Spafford (8, 9), claim that subterranean clover can be inoculated successfully into old grassland without previous ploughing ; liberal dressings of superphosphate appear, however, to be essential to its success

* This information was kindly communicated to Professor Stapledon by Dr. William Laidlow, of the National Herbarium, Victoria.

† Subterranean clover sown in 1920 on the Plant Breeding Station was found to be present, although of course in quite small quantities, in the sward in 1926, having withstood two ploughings in the intervening years. This field had been ploughed up in 1921 and used as a seed-production area for perennial rye-grass. It was reploughed in 1925 to be put down to a seeds mixture which was in its first harvest year in 1926.

under such conditions.* This method seems worthy of extensive trial under British conditions; such a system, if successful, would increase very materially the productivity of many of our grasslands, especially during the winter and spring months.

The value of this clover in the suppression of bracken is indicated by Mullett (7), who states that if the bracken be cut, and subterranean clover, assisted by the liberal use of superphosphate, successfully established in its place, the fern can be cleared or at least lessened in amount. If an early establishment is ensured, with a consequent rapid growth of clover, this, assisted by the trampling by stock, will help to suppress the young ferns; grazing animals will also to a large extent eat the succulent young fronds when seeking the highly palatable clover.

According to records in Australian works the total failure of this species as an economic plant would appear to occur only under the following conditions:—

(i) Where the rainfall is too low. Brunning (3) and others agree that less than 20 inches of rain per annum is too low for its successful growth. Reports from the Texas (U.S.A.) Station (5) also indicate that the clover is not a drought resister and is unable to re-seed itself when the ground becomes hard and caked.

(ii) On the heavy black soils of South Australia (10).

Seeding: (*a*) *Time of Seeding.*—The solution of this problem in Australia seems to be to sow before the advent of the autumnal rains; a good tilth is possible at the close of the dry season, and if sown at this time the seed will germinate readily at the first rains, establishing itself quickly and throwing up a good deal of fodder on to which stock can be turned in early spring. If allowed temporary freedom from grazing at flowering time, the plant is able to re-seed itself successfully before the dry season is far advanced. These seeds lie dormant during the dry period, germinating in the following autumn. In this manner the life cycle may be continued indefinitely, provided that the ecological and other conditions are suitable.

Experiments conducted in Texas by Leidigh (5) confirm in general the results from Australia, but show in addition that the clover remains winter green at the low temperature of 18°F. This is somewhat below our average winter temperatures

* See also footnote on p. 461.

in Western Britain, although our grass minima often fall below 20°F. (Aberystwyth), and under these conditions the plant has proved to be among the most frost-resistant of all species.

Stokes (12) reporting upon the behaviour of the plant in Florida (U.S.A.) states that autumn sowings have been successful on lowland country, but a similar sowing date applied to conditions in the pine lands of Florida was a total failure in two consecutive years. It is probable that we have here differences of climate analogous to those exhibited when British and Australian conditions are compared. In Australia an autumn sowing is the best, and it is conceivable that climatic conditions in the lowlands of Florida are of a somewhat similar nature to those obtaining in Australia and that thus late autumn sowings may be successful there. The Aberystwyth trials already reported upon,* as well as those to be discussed in the latter part of this paper, have shown that in Britain the date of sowing must be considerably earlier in the season in order to ensure the establishment of a strong plant, that is, one sufficiently vigorous to withstand the winter. Growth conditions in the pine lands of Florida are presumably more severe than the lowland conditions in that State, and hence it would seem that an earlier sowing date is necessary in order to produce well-established plants to withstand the adversity of a more rigorous winter.

(*b*) *Inclusion in Mixtures.*—Mullett (7) writing of conditions in Victoria (Australia) advocates the sowing of a mixture of subterranean clover with Paspalum grass (*Paspalum dilatatum*), the latter providing summer keep, while the clover can be depended upon to provide an abundance of winter fodder, the two plants being in this manner complementary to one another. Mullett also refers to the success in New Zealand of a mixture of English grasses plus Paspalum plus subterranean clover, pointing out that as the English grasses die back the resultant sward becomes dominated by the two other species. Spafford (8) has indicated that, in South Australia, a simple mixture of perennial rye-grass with subterranean clover has been successful in the production of permanent leys of high productivity.†

* See Williams and Davies (16).

† Professor Stapledon, who has recently returned from a tour in Australia and New Zealand, informs the writer that he was much impressed by the excellent swards in the Auckland district of New Zealand, consisting either almost wholly of subterranean clover and

(c) *Rate of Seeding.*—There seems to be considerable diversity of opinion as to the rate of seeding of the clover. Makin (6) advocates as much as 12 lb. per acre when sown alone, whereas Deem (4) states that the custom in the Mount Barker district of South Australia is to sow 4-8 lb. per acre of cleaned seed, using a bushel per acre of oats as a nurse. Adams (1), on the other hand, advises the use of only 1 lb. per acre in Western Australia, whilst indicating that as little as ¼ lb. per acre can be used, if very careful grazing management is undertaken during the early harvest years. Adams strongly emphasizes the necessity of only light grazing during the first season, so as to ensure that a good initial establishment of the clover with abundant re-seeding shall take place.

Seed Production.—In Australia, paddocks are put up to seed in late spring. When the seed is ripe the paddock is either horse- or hand-raked, or more recently a special harvester is used. Not more than 70 to 80 per cent. of the seed heads are gathered even by the best of these methods, and hence the same paddocks can be put up to seed season after season without harming the stand of clover. The seed is cleaned out of the heads either by first chaffing and then using the usual huller, or latterly by means of specially constructed thrashers. It is stated by Deem (4) that 300 lb. of cleaned seed per acre is considered a good yield, well-harvested seed selling on the farm at 2s. 6d. per lb. in 1925. (South Australia.)

Manurial Treatment.—Phosphates appear to be highly beneficial to the growth of the clover, various writers advocating from ¾ cwt. to 2 cwt. per acre of superphosphate, to which, in Australia, it is said to respond better than to basic slag. Spafford (10) says superphosphate is essential under all conditions in the Commonwealth for the successful development of this species. The manure may be applied in the autumn on dry soils or in the spring on wet soils, usually as a top dressing. Mullett (7) advises the application of 2 cwt. superphosphate at seeding time, followed by a biennial top

Paspalum or of subterranean clover and English grasses. The former combination, under proper management, affords abundance of both winter and summer keep—the subterranean clover having the additional great advantage of very largely preventing the Paspalum from becoming sod-bound. Prof. Stapledon's experience, moreover, serves to emphasize further the extreme importance of the management factor in relation to the proper establishment and utilization of this valuable clover.

dressing of 1-2 cwt. per acre, whereas Brunning (3) states that ¾ to 1 cwt. per acre is sufficient.*

Breeding and Selection.—Little attention seems to have been given to breeding work on subterranean clover, but Adams (1) claims to have distinguished at least three main forms, classified by him as follows :—

(*a*) *Early Flowering.*—A strain with small leaves and a high percentage of stem. The leaves have white markings, often with red flecks. This form is said to be useful in the drier areas of Western Australia, being capable of maturing and setting seed early, thus completing the vegetative period before the drought, which sets in sooner than in many parts of the Continent.

(*b*) *Mid-season Strain.*—This is more leafy than the last, but has similar types of leaf markings ; it is said to be the one most generally grown in Australia.

(*c*) *Late Flowering* (" *Wenigup* ").—This flowers about a month later than the mid-season strain and is more vigorous in growth ; it can be readily distinguished by the absence of leaf markings.

Observations made on plants of subterranean clover found growing wild about Aberystwyth show that they have both white and red leaf markings, and comparisons made on 10 plants of these with 10 plants of the Australian variety, grown at the Station, have shown that the latter were not so pronouncedly leaf-marked as the former, indicating that the two lots belong to distinct strains. The following statement demonstrates the difference in degree of leaf markings in the plants studied :—

	White leaf marks	Red flecks (anthocyanin)
" Wild " ex-Aberystwyth ..	100	100
Ex-Australian seed	59	12

* Professor Stapledon states that cases have come under his notice in Western Australia where subterranean clover has been sown on semi-cleared land without any cultivations whatsoever, which when supported by light dressings of superphosphate have given rise to quite remarkable stands of immense value for sheep feed. He also states that since the recognition of the importance of superphosphate in connexion with the clover a considerable stimulus has been given to seed production and that the average yield of dressed seed per acre has very materially increased. This fact, together with the introduction of improved harvesting and thrashing machines, has been largely responsible for subterranean clover now definitely ranking as a really valuable herbage plant of which the seed is an important commercial commodity.

Leidigh (5) refers to " clystogamous " seeds and in at least one instance claims to have found " seed pods " attached to the root of a subterranean clover plant but without finding seeds inside the " pods."

Diseases.—Subterranean clover is fairly free from diseases, both those caused by insect and by fungus pests. In Australia occasional damage is caused by the lucerne flea (*Smynthurus viridis*) and also by the pea mite (*Motophallus bicolor*). According to the writings of Mullett (7) and of Spafford (8), heavy grazing of a pasture, or the spraying of a hay crop with arsenical or other sprays, is said to be means whereby these pests may be checked. Two root diseases, root-knot and " rhizoctonia " are reported upon by Stokes (12, 13).

PART II

The Aberystwyth Trials, 1924 to 1926.—As a result of trials already reported upon by Williams and Davies (16) further plots of subterranean clover were broadcast at two sowing dates in 1924, alone and in a mixture with Italian rye-grass. Four one-twentieth acre plots were laid out as follows :—

	Lb. of seed per acre			
Date of sowing :	April 25, 1924		June 16, 1924	
Number of plot :	1	2	3	4
Subterranean clover	4	4	8	8
Italian rye-grass	—	14	—	14

The experimental area had been ploughed in 1923 and reploughed in April, 1924, preparatory to the first sowing. By June, however, the unsown half had become very weedy, thistles (*Carduus arvensis* and *Sonchus oleraceous*) being especially abundant, and this necessitated a thorough scarifying of the surface before sowing the seeds. Scarifying did not, however, kill off the thistles, whose rapid spread was facilitated by reason of the wet summer of 1924. The take and establishment of the sown seeds were, however, satisfactory on all plots, being possibly better on the earlier sown plots. All plots were lightly grazed during the autumn of 1924 and the spring of 1925, the clover in plots 1 and 2 providing more autumn keep but less spring keep in those years than that on plots 3 and 4. Sheep grazed the area intermittently throughout the early summer, and the plots were not " put up " to hay until June 6, 1925, the light hay crop being cut on June 30. The green-weight yields of subterranean clover in the hay are given in Table I.

TABLE I.—Yields of subterranean clover in the 1925 hay cut; average green weights in lb. per acre (1st harvest year)

Plot		Average lb. per acre	Relative green weights
April sown	1. Without rye-grass ..	26	0·5
,, ,,	2 With rye-grass	27	0·5
June sown	3 Without rye-grass ..	5,147	100·0
,, ,,	4 With rye-grass	1,812	35·2

It will be seen that plot 3 (sown in June) had the highest aggregate yield in 1925 hay, contributing nearly three times as much clover as plot 4, and about 200 times as much as plots 1 and 2 (sown in April).

The April-sown plots had flowered freely in 1924, setting some seed which had germinated, but the majority of the young seedlings were unable to withstand the winter, self-seeding being too late to ensure the production of strong plants that could withstand the severe weather. Meanwhile the old plants derived from the April sowing had died down. The 1925 hay on plots 1 and 2 thus contained only produce from the few self-sown clover plants that had overwintered successfully. These plants were, however, not vigorous enough to flower in profusion until well on in 1925, the seed being again set too late for production of strong seedlings for successful overwintering. This resulted in a still lesser amount of subterranean clover in the 1926 hay, and, judging from present appearances, there will be no plants on these plots in 1927.

The June-sown plots, on the other hand, produced plants that were capable of overwintering, giving very material keep at mid-winter and in spring. Seeding was too late for flowering to take place in 1924; thus the plants acted as winter annuals, growing vegetatively throughout the winter and flowering freely in June of the first harvest year. Seed was set which germinated in early July, again producing plants sufficiently strong to withstand the winter. The cycle was repeated in 1925-26, the buried seed germinating abundantly after the heavy rains of mid-July, 1926. In West Wales, therefore, a June sowing of subterranean clover is capable of producing plants that can act as typical winter annuals, whereas an earlier sowing has the tendency to form plants all or most of which attempt to flower and set seed during the seeding year. Sowings made about June or early July will thus produce abundant winter pasturage, and at the same time the plants may act in a way as perennials in

that they form permanent elements in the sward by means of a succession of re-seedings.

TABLE II.—Percentage yield of subterranean clover in hay.
Cut July 9, 1926 (2nd harvest year)
Average of plots 1 and 2, April sown, 1·4 per cent.
" " 3 " 4, June " 30·5 "

Counts made of the number of seedlings found on the various plots in September, 1926, when most of the 1926 seed had germinated reveal that the number of plants from the original June sowings had substantially increased.

TABLE III.—Average number of plants of subterranean clover per 10 readings (=2½ sq. ft.) analyzed September 14, 1926 (2nd harvest year)

Plot	Number of plants	
1	2	April, 1924, sowings
2	2	
3	475	June, 1924, sowings
4	958	

On plot 4 an average of 958 seedlings per 2½ square feet* were counted, and this is equivalent to a seeding of upwards of 220 lb. per acre. Plot 3 had an average count of 475 plants for a similar area, equivalent to a seeding of over 109 lb. per acre, whereas plots 1 and 2 only carried an average of about two plants per 2½ square feet, representing a seeding of less than ½ lb. per acre.†

It is difficult to assign the reason for the lesser number of plants on plot 3 as compared with plot 4; in 1925 the position was the reverse (see Table I), subterranean clover being an altogether denser stand on plot 3, although this was no doubt in great part due to the larger individual plants on this plot, a fact which can be explained as being due to the competitive effect of Italian rye-grass. It is possible, too, that on plot 4 the clover was better able to establish itself from self-seeding because of bare spaces left by the dying back of many rye-grass plants.

Calculations of the percentage ground covered by leafage of subterranean clover were made prior to the 1926 hay cut, and the figures obtained are given in Table IV. These data again show the very distinct difference between the two series of plots, the clover on the plots sown in June covering on an average over 40 per cent. of the ground space, whereas

* Three quadrats were taken per plot; 10 readings by the 6 inch × 6 inch mesh being made on each quadrat.

† In these calculations the real value of the seed is assumed to be 100 per cent., the weight per 1,000 seeds (=grain weight) is taken to be 6·00 grammes, and it is assumed that every seed produces a plant (*i.e.*, per cent. establishment=100).

only occasional plants occurred on plots sown in April, these covering no more than 2 per cent. of the ground.

TABLE IV.—Percentage ground covered by leafage of subterranean clover previous to cutting hay. Three quadrats per plot, with 10 readings (6 in. × 6 in.) per quadrat. Analyzed July 2, 1926. (2nd harvest year.)

Plots 1 and 2, April sown, 2 per cent.
,, 3 ,, 4, June ,, 41 ,,

To recapitulate: it has been shown that to enable subterranean clover to act as a winter annual and to enable it to re-seed itself year after year it is best sown in Wales about June. Observations made on this species, growing wild on old grassland in the Aberystwyth district, show that this also flowers and re-seeds itself during June and July, and is able to act as a permanent element of the pasture. The results relative to subterranean clover would seem to indicate that there may be an optimum date of sowing in the case of other of our winter annuals. For example, suckling clover (*T. minus*) is difficult to establish from seeding as a permanent element in grassland, and yet it almost invariably makes an unsown indigenous appearance even in the early years of the ley. It may be that in this case, too, we have still to find the right date of sowing to ensure annual re-seeding.

The use of subterranean clover as an autumn catch-crop to provide autumn keep on short-duration grassland is at the present cost of seed not an economic proposition in Britain. Moreover, such species as crimson clover (*T. incarnatum*) provide abundant stubble grazing under favourable conditions, whereas Italian rye-grass can provide valuable winter and spring fodder at a far lower outlay.

As an element of more permanent swards, however, subterranean clover may have greater possibilities under carefully adjusted conditions. Sown at the right time of year the plants will each season overwinter as strong seedlings, flowering the following year. It is essential that abundant re-seeding be assured, and therefore the swards would have temporarily to be rested for purposes of flowering and seed setting. A light hay crop could be taken off in early July and, possibly, sheep turned in afterwards to trample down any seed pods not sufficiently buried. This would seem to be especially applicable to the older swards where the herbage is densely matted, successful seed burial being more difficult under these conditions than on a more open type of pasture.

If subterranean clover can be successfully established on pastures it will very materially increase the stock-carrying

capacity of our grassland, by increasing the relative amount of winter keep as compared with that of summer. A greater head of stock per acre could therefore be kept all the year round without resort to either the "foggaging" of pastures which never seem well grazed or to increasing unduly the amount of stall feeding.

By a careful adjustment of the sowing date, the clover can produce abundant winter keep which is highly palatable to stock, comparing favourably in this respect with Italian rye-grass. Its success is, however, very largely dependent upon management and, as Australian experience would suggest, upon a liberal supply of phosphates. It may be, too, that the ecological conditions under which the Aberystwyth trials were conducted have been especially favourable to the success of the clover. The soil conditions were poor and the soil itself shallow, and it is true that the plant is found growing wild mainly on the thinner soils of the district. There seems no evident reason, however, why the clover should not succeed on more varied soil types, so long as the grazing management is correctly adjusted.

Summary and Conclusions.—Much Imperial and foreign literature dealing with the culture of subterranean clover has been under review, and the main points of interest emerging have been summarized. Observations made on the clover in the course of trials recently conducted at Aberystwyth have been discussed together with the conclusions arrived at.

A number of observations which have a practical bearing and should be of interest to British agriculturists may be summed up as follows :—

(i) Subterranean clover is said to have been originally imported into Australia as an impurity in agricultural seeds. During the last decade it has been widely grown as a valuable fodder plant, increasing the carrying capacity of much second-rate land in Australia. It does not, however, appear to be recommended for first-class lands, where it is said to check the growth of such species as white and alsike clover. Mixtures of subterranean clover with perennial rye-grass and with Paspalum grass (*Paspalum spp.*) have been recommended by Australian writers.

(ii) It is said that the clover will not thrive where the rainfall is below 20 inches annually. In Australia it responds very well to dressings of superphosphate; indeed, liberal dressings of this manure seem to be essential to its success in

many areas. Where conditions are suitable it seems to be an aggressive species in pastures. On the Station plots, however, it was not so aggressive as Italian rye-grass in the first year, and in hay its yield was materially lowered by the inclusion of that grass.

(iii) The date of sowing of subterranean clover is in Wales of the utmost importance and varies according to the requirements to be fulfilled. If permanent establishment in grassland is required the best time of sowing is late June, whereas for the production of abundant late summer and autumn keep an early sowing in March or April is best. High prices ruling for seed of this clover at present, however, prohibit its use merely as a catch-crop. In Australia an autumn sowing is said to be the best; the plants vegetate during the mild winter months and flower in spring. The buried seed lies dormant in the surface soil through the hot summer, germinating at the first rain of the following autumn.

(iv) Three distinct types of subterranean clover are said to be distinguishable according to (*a*) time of flowering; (*b*) ratio leaf to stem; and (*c*) degree of leaf markings.

(v) Only occasional damage seems to be done to the clover by either insect or fungus pests. Lucerne flea (*Smynthurus viridis*) and pea mite (*Motophallus bicolor*) sometimes occasion damage in the seed-production paddocks in Australia, whereas two root diseases are reported from Florida (U.S.A.).

Thanks are due to Mr. Ll. I. Jones, B.Sc., and Mr. I. G. Lewis for assistance given in making counts of plants and in botanical separations of the hay.

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AUGUST ON THE FARM

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Seasonal Notes.—At the time of writing—mid-July—it is difficult to visualize the husbandry of August when that normally appertaining to June has not yet been completed. Of one fact we may be certain, namely, that there will still be considerable areas of hay out when August comes in. For three weeks the mowing machines have stood waiting for the promise of a few fine days in which to make and gather a few acres; and now, with a less pessimistic tone in the forecasts and a fairly steady barometer, farmers seem to be hopeful that the requisite spell of fine weather is approaching and have re-started the machines.

The delay, should it prove to have been only delay, of about three weeks in the date of cutting has not been all disadvantage. Owing to the dry and chilly weather of May and the first half of June, the old land hay crops in many districts were light and benty at the time when, had weather permitted, cutting would have begun. The subsequent growth, being mainly leaf, should according to modern views be of a more nutritious character although it has not been secured in June, and certainly the weight of crop has increased. Leafy grass, however, requires more fielding than the normal mixture of leaf and stem; and in some cases it may be better to leave one or two fields unmown for winter pulling than to run the risks of overheating by trying to get on too fast. In some fields where there was a good growth in June, the bottom herbage is now brown and decayed. This not only makes cutting and curing more difficult but ruins the prospect of making the crop into good sweet hay.

In the earlier districts there has been heavy loss of clover and lea mixtures cut about the middle of June. Apart from that, the area of spoilt hay is as yet less than I have observed under similar weather conditions in past years. Farmers have exercised more restraint in the matter of mowing. The weather report, "further outlook unsettled generally," has been read or heard with exasperation, but it has prevented the resumption of mowing crops which otherwise might have been cut and afterwards ruined in the swath.

Corn Crops.—It would appear that, no matter how hot and dry the next spell of weather may be, corn harvest will be rather late this year. This may be advantageous, having regard to the delay with the hay crop ; but with so much green growth in the bottom of the straw, farmers will be tempted to begin reaping as soon as conditions will permit. As regards grain yields, the heads of wheat are not so large as the bulk of straw might lead one to expect, and the proportion of empty spikelets at the base of the ears is rather larger than usual. Smut of the "blow away" type, *i.e.*, loose smut, is rather prevalent this year, especially in spring-sown wheat. It is not generally understood that dressing the seed with bluestone or formalin does not prevent an attack of loose smut in wheat or barley if the seed is infected with this disease. The grain from an infected crop should not be reserved for seed.*

The bulk of straw, which at one time seemed likely to be small, has increased considerably, but as yet comparatively little lodging has occurred. Whether the additional straw is quite welcome in some of the arable districts is doubtful. Some arable farmers have much of last year's straw on their hands, having been reluctant to feed so many bullocks as would have been required to convert all the available straw into manure. Seeing so many apparently surplus straw stacks in one of the Eastern counties, it was difficult to suppress two ideas that conflict with the generally accepted rules of good husbandry. The first was as to the possibility of transporting some of this straw to grassland dairying districts where in winter the supply of bedding is short. Selling straw is permissible, provided that other measures are adopted for keeping up the humus supply of the soil, and the case for handling the cash value of produce at the first opportunity is a strong one. The other idea was as to whether it is essential to convert straw into manure—by means of bullocks or otherwise—before returning it to the soil : is there no point in the rotation where

* See the Ministry's Leaflet, No. 92, *Bunt and Smut in Wheat.*

straw can be incorporated in the soil so as to secure the full benefit of its organic matter as a source of humus and without the denitrifying effects of fresh straw injuring the succeeding crop? It would appear that the time and place satisfying these conditions is in autumn, after corn and before roots and potatoes. At any rate, if bullock feeding continues to be a source of loss to the arable farmer it is desirable to experiment on these lines.

August Sowings.—August is a month in which seeds will germinate well, and the list of plants suitable for sowing at this time of the year is long. In the ordinary four- and five-course rotations, however, there is little land available for sowing in this month. Cabbages may be sown in seed beds for later planting out in the field; but the sowing of stubble turnips, trifolium and similar catch crops is practised only in specially favourable districts and after an early harvest.

Where early and second early potatoes are grown, good use can be made of Italian rye-grass. If sown immediately the potato crop is lifted, a good bite of lamb feed may be obtained in less than two months' time, after which the grass may either be left for further grazing in the following winter and spring or ploughed under. The value of Italian rye-grass for early spring feed, however, is not sufficiently appreciated either by flock masters or by dairy farmers. The milk producer need not regard April as a winter month if he can provide a field of Italian rye-grass sown not later than mid-September and suitably fertilized, not omitting the top dressing with nitrogenous manures in March.

Quality of Milk.—From time to time I receive visits from farmers who have been informed that their morning's milk is poor or below the 3 per cent. "standard." Recently, and due possibly to the peculiarity of the weather conditions, cases of difficulty in this matter have been rather more numerous than usual. As a rule the farmer brings in samples for testing and almost invariably he is surprised at the low fat content of the samples tested. Sometimes considerable differences will be found between milks taken from different churns which cannot be accounted for by insufficient mixing before taking the samples. Nearly always there is wide divergence between the results of the evening and the morning milks.

Without entering into the questions of whether the properly mixed milk of a herd may fall below the 3 per cent. "standard,"

it can be said that farmers would receive fewer warnings and complaints if they were aware of the possibility of wide variations in quality and endeavoured to prevent these variations. Samples may be submitted to the local agricultural college or county agricultural education department for testing at merely nominal charges.

One of the chief causes of low fat content in morning's milk is a long interval between the afternoon and the morning milkings. There are, in most herds, periods when the morning samples tend to be unusually low in fat. At these times arrangements must be made to milk at more nearly equal intervals. Generally it is the cows that are in or are just past full yield and have lost flesh that give the poorest milk : these should be milked first in the morning and last in the evening. This procedure must not be adopted, however, without taking the further precaution of thoroughly mixing the milk of these cows with that yielded by the remainder of the herd. Grouping the cows according to yield and stage of pregnancy may be a convenience in feeding and general management, but I have known it lead to quality troubles where the milk of all the groups has not been properly mixed before dispatch. The simplest method is to arrange for the milk as it leaves the cooler to run into two or more cans at the same time.

Recent legislation provides for an " appeal to the cow " in certain cases where the producer desires it. If, for example, a London local authority finds a churn or can of milk in course of delivery to be deficient in fat or non-fatty solids, the producer is notified accordingly. He has the right within 60 hours to apply to the Food and Drugs Inspector of the same local authority to take a sample of the milk from a corresponding milking of his cows. The Inspector in taking the sample will take special care to ensure that the sample he takes shall be thoroughly representative of the mixed milk of the whole herd, thoroughly milked and stripped. In most cases the results of the analysis of such a sample would be better than that of the sample complained of, which might be from one of three churns, two of which were well above the standard. Appeal to the cows is therefore unlikely to aid the defence unless the farmer had himself taken all possible precautions in the production and dispatch of the milk from which the deficient sample or samples were taken.

Telegony.—The question of whether telegony is based on supposition or fact has been raised by two readers. Only one of the queries need be discussed and it is not an uncommon type

of case. A Shorthorn bull broke bounds and impregnated some pedigree British Friesian cows and heifers. The resulting calves will, of course, be cross-breds, but the question at issue is whether the subsequent calves of these cows and heifers, if bred to pure British Friesian bulls, will show Shorthorn characteristics. In other words has the Shorthorn bull tainted the blood of the Friesian females ?

Not many years ago teachers of the theory of breeding included telegony in their lecture material as established fact. The present-day student of the subject is very sceptical of the

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending July 13				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½%) ..	14 15	..	14 0	14 12	18 10
Sulphate of ammonia :—					
Neutral (N. 20·6%)	12 6*	12 6*	12 6*	12 6*	11 11
Calcium cyanamide (N. 19%) ..	9 16*	9 16*	9 16*	9 16*	10 4
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 16	4 0
Potash salts (Pot. 30%)	4 17	..	..	4 12	3 1
„ (Pot. 20%)	3 12	..	3 9	3 4	3 2
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 5	3 5
Sulphate „ „ (Pot. 48-51½%)	11 10	10 5	10 16	11 2	4 4
Basic Slag (T.P. 32%)	3 4§	..	2 19§	..	..
„ (T.P. 30%)	3 2§	..	2 17§	2 15e	..
„ (T.P. 28%)	..	..	2 10§	..	..
„ (T.P. 26%)	..	..	2 5§	..	..
„ (T.P. 24%)	2 10§	..	2 2§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10d	0 10
Fine grade‖	2 10	..	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	..	..	3 12	3 0	1 9
„ (S.P. 33%) ..	..	..	3 9	..	..
„ (S.P. 30%) ..	..	2 15	3 5	2 15	1 10
Bone meal (N. 3¼%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ¼%, T.P. 60-65%)	6 0†	6 2†	6 5	5 17	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of towns mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Prices for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.O.R. Northern rails ; 3s. 6d. per ton extra on Southern rails.

possibility of telegonic influence. Several experiments have been carried out in which conditions were made as favourable as possible for such influence to be demonstrated, but all the results have been negative.

Apart from the above considerations, it is always a matter for regret when a bull breaks bounds. Many farmers have not a suitable paddock in which to allow the bull liberty without fear of his escape. Accordingly the bull is very commonly shut up in a loose box, where he gradually develops a fierce disposition and often becomes of little breeding value as a result of lack of exercise. The best solution in such cases appears to be that of tethering the bull in the field to a strong wire securely held down at both ends.

* * * * * *

NOTES ON FEEDING STUFFS FOR AUGUST

H. E. WOODMAN, PH.D., D.SC.,
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The Energy in the Ration.—The farmer hears the term "net energy" so frequently nowadays, in connexion with feeding stuffs and rationing, that it may not be out of place to attempt, in this month's Notes, to give some idea of what this conception signifies. All living things on earth, both plant and animal, are in truth but simple creatures of the sun, and batten, directly or indirectly, on the energy which, from time's beginning, has streamed out continuously from the great central luminary towards this planet in the form of light waves. The energy of the sun, though not necessarily the initiator of life, would seem to be in the strictest sense its indispensable support.

How comes this to be? To answer this question, we must recognize that the existence of animals without plant life is not conceivable. The plant is the great elaborator of the food of animals. It alone (if we except the synthetic art of the chemist) is able to bridge the gulf between the worlds of inorganic and organic matter. The mysterious activities in the minute plant cell laboratories, whereby this is rendered possible, are, however, dependent on the supply of solar energy. The plant absorbs carbon dioxide, a gas which is a waste product of animal life. Under the influence of light absorbed by the chlorophyll of the plant, this is converted, by subtle and only vaguely understood changes, into complex organic compounds like carbohydrates and oils, and in these substances are locked up, in the chemical or potential form,

the vast stores of energy which have been derived from the sun.

The work accomplished by the sun in this process is enormous. Every gramme of carbohydrate thus elaborated in the plant involves a storage of solar energy to the extent of 4,100 calories; in other words, an amount of energy which, if liberated as heat, would raise the temperature of nearly a gallon of water through one degree centigrade. This locked-up energy becomes manifest as heat and light when the carbohydrate is burnt in an atmosphere of oxygen, which is the great liberator of imprisoned energy. In this process the carbon dioxide is set free once more and forms again the starting point of the eternal cycle of change. Oil is even a richer storehouse of energy than carbohydrate, and yields, when burnt in oxygen, two and a half times the amount of heat which is obtained from an equal weight of carbohydrate. Protein under these conditions gives out about one and a half times the amount.

A feeding stuff is, therefore, to be regarded as a mixture of complex organic compounds in which varying amounts of solar energy have been locked up. This energy is available, in part at any rate, to the animal, which is merely, in the scientific sense, a mechanism for the transforming of energy from one form to another. The principle of the conservation of energy holds as rigidly for the animal as for the clock or the engine. Part of the energy of the food is transformed into heat for keeping up body temperature. Another part is utilized for maintaining the blood circulation and the heart beat, or for the performance of muscular work. Still another portion may become locked up in the various organic compounds which are built up in the animal, such as reserve fat, the glycogen of the liver, the proteins of flesh or the constituents of milk. Thus it is apparent that life is fundamentally a phenomenon of energy exchange, the plant in the first place collecting and storing the energy of the sun and then passing it on to the animal.

Gross Energy.—The total locked-up energy of a feeding stuff may be determined very simply by burning a known weight of the material in an atmosphere of oxygen and measuring the heat which is evolved. This is usually referred to as the gross energy of the feeding stuff. Unfortunately, however, this maximum amount of energy never becomes available for productive purposes in the animal organism, for the following reasons :—

(1) A portion of the chemical energy of the food fails to be transformed at all. It leaves the body in the undigested food residues of the fæces, such parts of the food thus evading oxidation in the animal.

(2) The paunch of the ruminant is the seat of intensive bacterial activity. The micro-organisms concerned derive the energy for their own vital processes by breaking down a portion of the carbohydrate and fibre of the food. This implies, therefore, a reduction in the amount of energy which will be available to the animal. The bacteria themselves, however, seem incapable of utilizing the whole of the energy in the carbohydrate and cellulose, since marsh gas and hydrogen, substances rich in energy, are formed as waste products of their activity. The excretion of these energy-rich gases from the animal involves therefore an appreciable loss of food energy.

(3) The full energy of the protein constituent of the food is not liberated in the animal organism, since breakdown of protein does not proceed to the limiting stage of carbon dioxide, but stops short at urea. Thus, the urea which is excreted into the urine carries out of the body some of the energy which was originally locked up in the protein of the food.

(4) Shortly after consumption of food, there is always a distinct rise in the rate of heat evolution from the body. This effect is known as specific dynamic action, and implies that a proportion of the total energy of the food is inevitably converted into heat, a form of energy which cannot be re-transformed into chemical energy in the form of fat, flesh or milk. As the heat necessary for body warmth is derived from the maintenance portion of the ration, it follows that heat coming from the production part of the ration is wasted from the animal's standpoint. In other words, it is given off from the body, being useless for productive purposes. We may refer to this fraction of the energy of a feeding stuff as the thermic energy.

Net Energy.—It is clear from what has been written that, in order to arrive at the amount of productive energy in a feeding stuff, we must add together the thermic energy and the energy losses in the liquid, solid and gaseous excreta, and subtract the total from the gross energy of the food. The difference is an accurate measure of productive value. It is known as the net energy value, and is usually stated in therms (1 therm = 1 million small calories) per 100 lb. of feeding stuff.

When we refer to the productive value of a feeding stuff in terms of starch equivalent per 100 lb., we merely state the same thing in another way. Since 1 lb. of starch contains 1·07 therms of net energy, it follows that if we multiply the starch equivalent by this factor, then we convert the productive value into terms of net energy. In other words,

Starch equivalent per 100 lb. × 1·07
= Net energy value per 100 lb.

The system of starch equivalents has only been commonly adopted because of the convenience of the unit and the concrete picture of feeding value which it affords. Obviously, however, starch has no value to the animal as such, but only by virtue of the energy which it contains, energy which only becomes dynamic and useful during the process of destruction of the starch in the metabolic processes of the animal organism.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	11 4
Maize	81	6·8	7 14
Decorticated ground nut cake	73	41·0	11 5
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·52 shillings, and per unit protein equivalent, 1·08 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 12
Oats	60	7·6	7 19
Barley	71	6·2	9 7
Potatoes	18	0·6	2 6
Swedes	7	0·7	0 18
Mangolds	7	0·4	0 18
Beans	66	20·0	9 8
Good meadow hay	31	4·6	4 3
Good oat straw	17	0·9	2 4
Good clover hay	32	7·0	4 8
Vetch and oat silage	13	1·6	1 14
Barley straw	19	0·7	2 9
Wheat straw	11	0·1	1 8
Bean straw	19	1·7	2 10

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	12 17	0 15	12 2	72	3 4	1·78	9·6
Barley, British feeding	—	—	11 10	0 12	10 18	71	3 1	1·65	6·2
„ Canadian No. 3 Western	45 0	400	12 12	0 12	12 0	71	3 4	1·78	6·2
„ „ No. 4 „	39 0	„	10 18	0 12	10 6	71	2 11	1·56	6·2
„ Persian	36 0	„	10 2	0 12	9 10	71	2 8	1·43	6·2
Oats, English, white	—	—	10 13	0 13	10 0	60	3 4	1·78	7·6
„ „ black and grey	—	—	10 0	0 13	9 7	60	3 1	1·65	7·6
„ Scotch white	—	—	11 10	0 13	10 17	60	3 7	1·92	7·6
„ Canadian No. 2 Western	32 3	320	11 5‖	0 13	10 12	60	3 6	1·87	7·6
„ „ feed	29 0	„	10 3*	0 13	9 10	60	3 2	1·70	7·6
„ American	24 9	„	8 13†	0 13	8 0	60	2 8	1·43	7·6
„ Argentine	27 6	„	9 12	0 13	8 19	60	2 11	1·56	7·6
„ Chilian	28 0	„	9 16	0 13	9 3	60	3 1	1·65	7·6
Maize, Argentine	33 0	480	7 14	0 12	7 2	81	1 9	0·94	6·8
Beans, English winter	—	—	11 0†	1 10	9 10	66	3 0	1·61	20
Peas, Japanese	—	—	20 15‖	1 6	19 9	69	5 8	3·04	18
Dari, Egyptian	—	—	10 10	0 14	9 16	74	2 8	1·43	7·2
„ Syrian	—	—	12 0‖	0 14	11 6	74	3 2	1·70	7·2
Millers' offals—									
Bran, British	—	—	7 2	1 6	5 16	42	2 9	1·47	10
„ broad	—	—	8 2	1 6	6 16	42	3 3	1·74	10
Middlings, fine, imported	—	—	9 15	1 1	8 14	69	2 6	1·34	12
„ coarse, British	—	—	8 17	1 1	7 16	58	2 7	1·38	11
Pollards, imported	—	—	7 12	1 6	6 6	60	2 1	1·12	11
Meal, barley	—	—	11 17	0 12	11 5	71	3 0	1·61	6·2
„ maize	—	—	9 7	0 12	8 15	81	2 2	1·16	6·8
„ „ germ	—	—	9 0	0 18	8 2	85	1 11	1·03	10
„ „ gluten feed	—	—	8 15	1 5	7 10	76	2 0	1·07	19
„ locust bean	—	—	8 10	0 11	7 19	71	2 3	1·20	3·6
„ bean	—	—	12 0	1 10	10 10	66	3 2	1·70	20
„ fish	—	—	20 0	4 1	15 19	53	6 0	3·21	48
Maize, cooked flaked	—	—	10 5	0 12	9 13	85	2 3	1·20	8·6
Oilcakes—									
Linseed—	—	—	18 2	1 9	16 13	119	2 10	1·52	19
„ cake, English 12% oil	—	—	12 0	1 16	10 4	74	2 9	1·47	25
„ „ „ 10% „	—	—	11 12	1 16	9 16	74	2 8	1·43	25
„ „ „ 9% „	—	—	11 7	1 16	9 11	74	2 7	1·38	25
Soya bean „ „ 6% „	—	—	11 7*	2 11	8 16	69	2 7	1·38	36
Cottonseed cake „ 5½% „	—	—	6 15	1 13	5 2	42	2 5	1·29	17
„ „ Egyptian, 5½% „	—	—	6 12	1 13	4 19	42	2 4	1·25	17
Decorticated cottonseed meal, 7% oil	—	—	10 12‖	2 11	8 1	74	2 2	1·16	35
Coconut cake, 6% oil	—	—	9 7	1 9	7 18	79	2 0	1·07	16
Ground-nut cake, 7% oil	—	—	9 12†	1 14	7 18	57	2 10	1·52	27
Decorticated ground-nut cake, 7% oil	—	—	11 5*	2 12	8 13	73	2 4	1·25	41
Palm kernel cake, 6% oil	—	—	8 15	1 2	7 13	75	2 0	1·07	17
„ „ meal, 6% „	—	—	9 0*	1 2	7 18	75	2 1	1·12	17
„ „ „ 2% „	—	—	7 17	1 3	6 14	71	1 11	1·03	17
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1·20	2·7
Brewers' grains, Dried ale	—	—	6 17	1 2	5 15	49	2 4	1·25	13
„ „ „ porter	—	—	6 7	1 2	5 5	49	2 2	1·16	13
„ „ Wet ale	—	—	0 16	0 8	0 8	15	0 6	0·27	4·8
„ „ „ porter	—	—	0 12	0 8	0 4	15	0 3	0·14	4·8
Malt culms	—	—	7 10‖	1 12	5 18	43	2 9	1·47	16

Prices at London except where otherwise stated.

* At Hull. † At Bristol. ‖ At Liverpool

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of June and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is £1 2s. per ton. The food value per ton is therefore £8 18s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 12s. 0d.; P_2O_5, 3s. 10d.; K_2O, 3s. 0d.

MISCELLANEOUS NOTES

International Institute of Agriculture

THE second International Conference for Plant Protection has been fixed to take place early in November, 1928, so as to coincide with the work of the Ninth General Assembly of the Institute. The first Conference was held at the Institute's offices in Rome from February 24 to March 4, 1914, when a draft Convention was drawn up for submission to the adhering countries, providing for common action against the introduction and spread of plant disease. Owing to the outbreak of war a few months afterwards, the matter remained in abeyance, and, when the subject was reconsidered, it was felt that the time which had elapsed and the generally altered circumstances would necessitate amendment of the original draft Convention. The subject was further examined by an International Commission of Experts in Phytopathology which met a few days before the opening of the General Assembly in April of last year, and a revised draft Convention was agreed upon, and approved by the General Assembly. This revised scheme will be considered at next year's International Conference.

The Institute is to be officially represented at the following meetings: World Poultry Congress, to be held at Ottawa on July 27; Soil Science Congress (Washington, July 13); and the International Country Life Conference (East Lansing, Michigan, August 1). The International Cold Storage Congress will be held on September 19 at the Institute's offices in Rome.

* * * * * *

Midland College Poultry Conference

THE Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, will hold its fourth Annual Poultry Conference on Tuesday, September 13, 1927, and all persons interested are cordially invited to attend. These conferences, which last a day, are arranged to give residents in the locality and others who are unable to attend the National Poultry Conference an opportunity of hearing short papers by experts upon various aspects and problems of poultry keeping, and of joining in the discussions that follow. At the forthcoming Conference, the subjects for discussion will be of a practical character. At the morning session, Mr. F. W. Parton, Poultry Instructor, Department of Agriculture, Leeds University, will consider "Chicken Rearing," and Mr. R. Scott-Miller, F.Z.S., "The Selection of

Birds for Laying Trials." In the afternoon, Mr. C. H. Dobbin, Poultry Instructor, Lancashire County Council, will deal with the "Artificial Lighting of Poultry Houses," and Mrs. R. Crawford will speak on "Farm Poultry Keeping." Time will be allowed for the inspection of the College buildings and poultry runs, and also the Notts and Leicester Laying Trials, which are being held at the College. Particulars of the arrangements, accommodation for visitors, meals, etc., can be obtained on application to the principal, Dr. T. Milburn.

* * * * * *

The Stud Goat Scheme, 1926-27

THE object of this Scheme, it will be remembered, is to provide facilities for mating specially selected sires with the milch goats belonging to small-holders, cottagers, and similar persons. The improved stock already to be seen up and down the country testifies to the success which has attended the Scheme since its inauguration three years ago. Figures for the past season are now available, and, as appears from the following table, they compare favourably with those of the previous year :—

	Centres	Goats entered	Goats registered	Services given	Services allowed for premium	Premiums	Administrative and travelling expenses
1925-26	83	108	89	1,115	1,077	£229	£121
1926-27	100	115	104	1,603	1,496	£303	£117

It will be observed that while the total cost to the Ministry increased by only 16.7 per cent., the number of services allowed for premium shows an increase of 34.1 per cent. This is all the more gratifying when it is remembered that the Scheme was necessarily affected to some extent by the restrictions imposed under the Foot-and-Mouth Disease Regulations. The average cost per service allowed decreased from 2s. 2d. to 1s. 7d. Thirty-five new centres were opened, some in counties which had not been previously represented. The animals accepted included 7 Saanens, 8 Toggenburgs, 8 Anglo-Nubians and 81 Anglo-Nubian-Swiss or other definitions. Six of these goats were imported in 1922, 7 were sired by imported goats, 35 were "Dagger"* males, 21 owned "Dagger" males as sires, while 16 were from Star or Q Star dams.

As in preceding years, the inspection was undertaken by an officer appointed by the British Goat Society. Twenty-four

* *i.e.*, males whose dams, and (on the sire's side) granddams, have secured the Star or Q Star, indicative of descent from good milking stock.

days were occupied in this work, and a total distance of 2,870 miles was covered. Ninety-nine goats qualified for premiums, of which 28 (at 27 centres) earned the full premium of £5, 1 each in Berkshire, Cambridgeshire, Cheshire, Suffolk and Yorkshire, 2 each in Cumberland, Dorset (3 goats at two centres), Kent, Norfolk and Surrey, 4 in Essex, and 8 in Durham. These 28 goats gave 852 services, of which 813 were allowed. For the total number of services, Durham easily leads the way, 2 of the goats in that county having made 68 and 69 services, Cumberland coming next with 52, and then Essex with 46. Of the services allowed under the Scheme, 349 were given gratis, while fees varying from 6d. to 5s. were charged for the remainder.

At several shows last year, special classes were provided for female kids sired by goats under the Scheme, while, at other shows, special prizes were offered for such kids. These special prizes are to be increased for the current season. Evidence of increased appreciation of the value of first-class stock is afforded by the inquiries which are received from time to time for goats eligible under the Scheme. There can be no doubt as to the efficient and economical manner in which the Scheme has been administered, and as to the beneficial results which have already been achieved.

* * * * * *

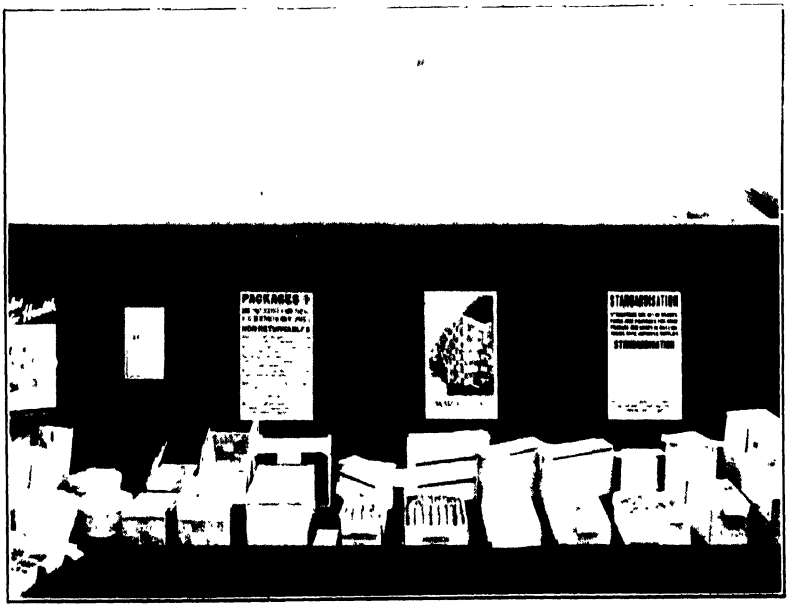
Marketing Demonstrations

THE practical demonstrations of improved methods of marketing, which are being carried out by the Ministry at selected Agricultural Shows during the present summer, were staged, in July, at the Royal Show at Newport and at the Great Yorkshire Show at Darlington. The demonstrations at Newport were concerned with pigs, pig products, eggs, poultry and fruit. Some illustrations of the demonstration in fruit marketing at the Bath and West and Southern Counties Show and at the Three Counties Show are given here. (Figs. 1 to 4.) At Darlington, fruit was omitted from the programme, which was otherwise the same. At both shows the demonstrations attracted crowds of visitors who showed considerable interest. The South African farmers at present visiting this country, and representatives of Young Farmers' Clubs from the United States, were among overseas visitors to the Ministry's Pavilion at the Royal Show. There was always a keen demand for publications, about 1,500 copies of the marketing reports in the Ministry's Economic Series being sold at the two shows.

To face page 480.

FIG 1.—View of part of Fruit Marketing Demonstration, Three Counties Show. Showing Grading and Sizing Machine in foreground.

FIG. 2.—View of part of Fruit Marketing Demonstration. Three Counties Show.



FIGS. 3 & 4.—Views of the Fruit Marketing Demonstration. Bath and West and Southern Counties Show.

FIG. 5.—Pig Marketing Demonstration : General view of the pig-products section.

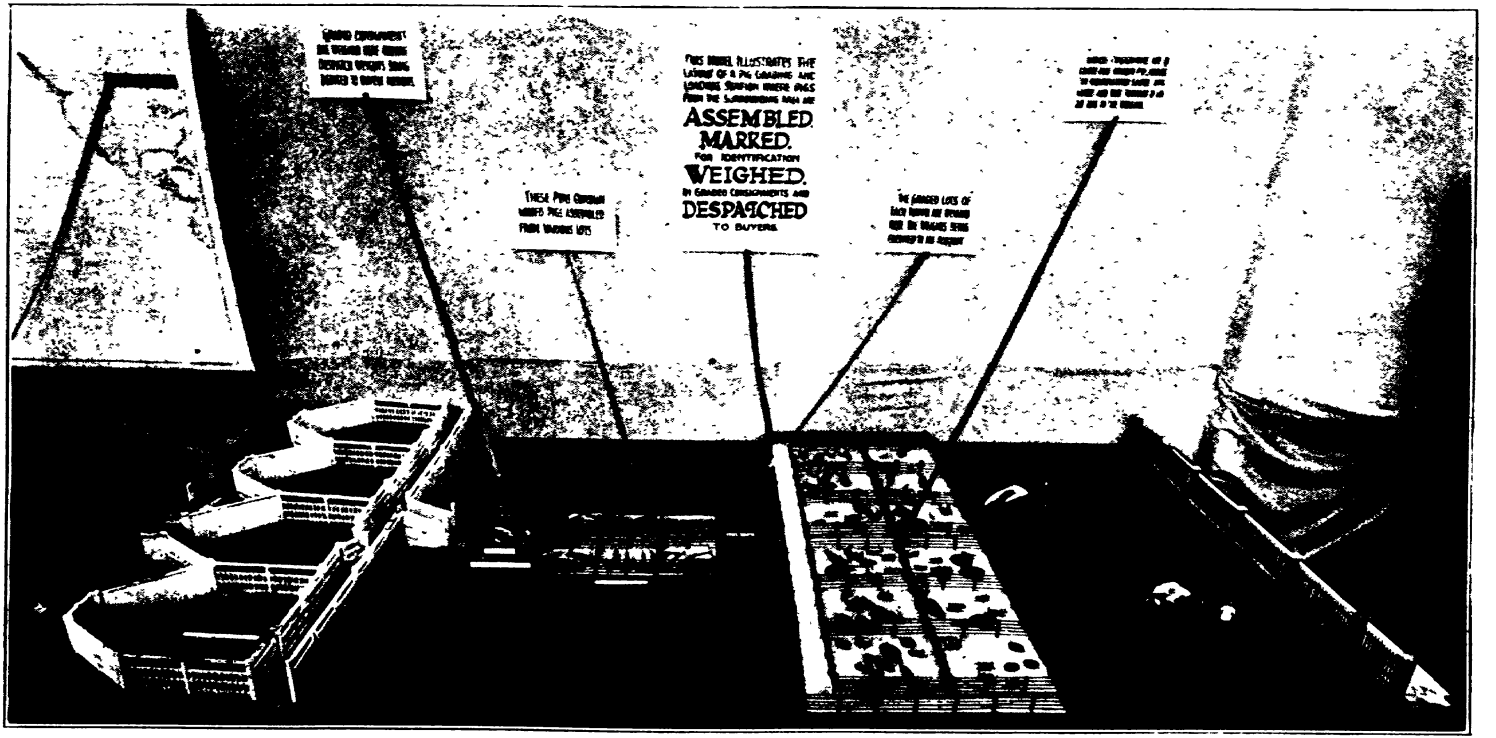


FIG. 6.—Pig Marketing Demonstration : Model of a pig-grading and loading station for the assembling, marking, grading and weighing of pigs from the surrounding areas, and their dispatch in graded consignments to district buyers. (See page 481.)

FIG. 7.—Pig Marketing Demonstration. View of the Commercial-Pig Exhibit. The pigs here shown were selected by the National Federation of Meat Traders' Associations and the Western Curers' Association as being of the types best suited to trade requirements.

FIG. 8. - Pig Marketing Demonstration. Sections relating to the Midland Trade and to Hams.

A new feature which aroused interest and discussion was a model of a co-operative pig-grading and loading station (Fig. 6). At such a station, pigs from the surrounding areas could be assembled, marked for identification, graded, weighed in graded lots—each sender's lots being weighed separately, re-weighed in graded consignments of mixed lots of similar grade, and dispatched to buyers. Organizations of this kind are common in the domestic trade of the United States and Canada, and there are interesting examples in Germany. There is, however, only one important example in England and Wales of a farmers' organization which is engaged in the business of assembling and grading live pigs for dispatch to distant buyers. This is the live stock department of the Eastern Counties Farmers' Co-operative Association at Ipswich, which operates five assembling centres and, in recent years, has handled about 60,000 pigs per annum. It is claimed by the Association that its system of bulking pigs for dispatch in graded consignments enables it to effect savings in transport charges, and to allocate uniform lots of pigs in large quantities to the bacon and pork markets according to exact requirements.

* * * * * *

Downy Mildew of the Hop : Warning as to Spraying

WITHIN the past few years, a new mildew of the hop—the so-called "Downy Mildew"—has made its appearance in various European countries, and has also been found in some hop gardens in England. This Downy Mildew is quite different from the well-known Powdery Mildew or "Mould" of hops which is of such frequent occurrence and is controlled by the application of sulphur. Fully illustrated and detailed accounts of the Downy Mildew of the Hop have been published in this JOURNAL (March, 1925, p. 1144; April, 1925, p. 30; May, 1926, p. 149; and March, 1927, p. 1108) and should be consulted by those interested. It is also briefly referred to in Miscellaneous Publications, No. 42, *Cultivation, Diseases and Insect Pests of the Hop Crop*, obtainable from the Ministry, 10 Whitehall Place, S.W. 1., price 2s. 6d. net, post free.

The Downy Mildew fungus is a near relative of that which causes the well-known Potato Blight, and it might, therefore, readily be assumed that spraying hops with Bordeaux or Burgundy mixtures would be a suitable means of controlling it. In one instance, indeed, on the Continent, such a procedure has been recommended. In this country, however, this

is not desirable; for, although such mixtures might, and probably would, suppress the mildew, yet, if they reached the hop cones, the copper contained in them would render the cones entirely unsuitable for brewing purposes. *Growers are, therefore, warned that hop cones should not be sprayed with the mixtures mentioned.* For the present, indeed, it is deemed wise not to spray hops at all with these mixtures, but to adopt the control measures suggested by Professor Salmon and Mr. W. M. Ware in the issue of this JOURNAL for March, 1927, p. 1118 *et. seq.*

* * * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on July 19, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions.

Cambridgeshire and Isle of Ely.—An Order fixing special minimum rates of wages for the employment of male and female workers during the corn harvest, 1927. The rate in the case of male workers of 21 years of age and over is £11 for a period of four weeks of 64 hours per week, with payment for all employment on Sundays and in excess of 64 hours per week at 11d. per hour. In the case of female workers of 18 years of age and over, the special minimum rate for all employment on harvest work is 8d. per hour.

Essex. An Order fixing special minimum rates of wages for employment of male and female workers on the corn harvest of 1927. The rate in the case of male workers of 21 years of age and over employed on the harvest throughout the harvest period on farms of more than 60 acres of corn is £5 5s. 0d. for the period in addition to the ordinary weekly minimum rate applicable to such workers. In the case of male workers, who are employed on harvest work for a part only of the harvest period, a proportion of the sum mentioned above is payable, whilst, in the case of male workers of the same age who are employed on farms of 60 acres of corn and under, the special rate is 10½d. per hour for all employment on harvest work. In the case of female workers of 21 years of age and over, all employment on harvest work is to be paid for at not less than 7½d. per hour.

Hertfordshire.—An Order fixing special minimum rates of wages for employment of male and female workers on the corn harvest in 1927. The rate in the case of male workers of 21 years of age and over is 10½d. per hour, and in the case of female workers of the same age, 7½d. per hour for all employment on harvest work.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * * *

Special Minimum Rates of Wages for the Corn Harvest.—In addition to the eight Agricultural Wages Committees mentioned in the July issue as having fixed special minimum rates for the corn harvest (Derbyshire, Devonshire, Dorset, Hampshire and Isle of Wight, Norfolk, Somerset, Wiltshire, and the East Riding of Yorkshire), Orders have since been made in respect of such rates for Cambridgeshire and Isle of Ely, Essex, and Hertfordshire, and particulars of these Orders will be found above.

A notice of proposal has also been issued by the Suffolk Agricultural Wages Committee to fix bonuses to be paid in addition to the ordinary minimum wage to male workers employed throughout the harvest period on harvest work on farms of at least 60 acres of corn, the bonus in the case of workers of 21 years of age and over being £5. In the case of other male workers special hourly rates are proposed for all employment on harvest work, the rate in the case of adult male workers being 10d. per hour.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending July 15 legal proceedings were instituted against five employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines	Costs	Arrears of wages	Workers concerned
		£ s. d.	£ s. d.	£ s. d.	
Yorks,N.R.	Thirsk ..	1 12 0	0 2 6	To be agreed	1
Lancs. ..	Chorley ..	2 0 0	4 3 0	1 8 6	1
Durham ..	W. Hartlepool	10 0 0	0 10 0	15 9 3	2
Glam. ..	Neath ..	—	5 5 0	11 14 6	1
Hants. ..	Whitehill ..	30 0 0	—	101 5 0	6
		£43 12 0	£10 0 6	£129 17 3	11

* * * * * *

Appointments at the International Institute of Agriculture.—The Permanent Committee of the International Institute of Agriculture at Rome invites applications for several appointments as "Redacteur." The minimum initial emoluments are 22,750 liras per annum. The travelling expenses (second-class) of successful candidates will be repaid on taking up their posts. Members of the staff living at a distance of over 1,000 kilometres from Rome have a right to the payment once in three years of their travelling expenses to their native countries. Candidates should possess a knowledge of foreign languages, good general academic qualifications and/or special knowledge of one of the following subjects, namely: Agricultural Economics, Tropical Agriculture, Dairy Science and Plant Diseases.

Applications should be addressed to the Bureau du Personnel, Institut International d'Agriculture, Villa Borghese, Rome, and must be received not later than August 31, 1927.

* * * * * *

Foot-and-Mouth Disease.—The existence of foot-and-mouth disease was confirmed on July 7 at Wigginton, near Tamworth, Staffs. This was the first case to occur in Great Britain after a period of three months' complete freedom from the disease. A further case was confirmed in the same parish on July 10. A fresh centre of disease was also discovered at Hunton, near Maidstone, Kent, on July 19.

Twenty-six outbreaks in all have been confirmed since January 1 last, involving nine counties and the slaughter of 1,152 cattle, 881 sheep, and 353 pigs.

NOTICES OF BOOKS

The British Goat Society's Year Book for 1927. (London: Compiled and issued by the Honorary Secretary, Thomas W. Palmer, 10 Lloyd's Avenue, E.C. 3. 180 pp. Price 1s. 6d. net.)

The seventh issue of this useful annual, which contains numerous illustrated articles, dealing with practically every aspect of modern goat-keeping, should appeal to all interested in goats.

There can be little doubt that the milk yield of goats is improving. In 1919, two goats are recorded as having given 10 lb. or over in 24 hours; last year the number had increased to 44. These yields were obtained under the adverse conditions inseparable from shows, and it may be safely assumed that the normal average of the animals concerned was considerably higher. A good example of the possibilities of the milch goat is furnished by Didgemere Dream Q**. Her yields of 18 lb. 7 oz. in 24 hours at the Royal Norfolk Show, and of 4,236 lb. 4 oz. for the year ending October 1, 1926, constitute records. In her present lactation, she has yielded 4,703 lb. 2 oz. in 345 days.

Dr. Hare, of the Department of Pathology in the University of Liverpool, supplies some practical notes concerning the proper treatment of sick goats. Mr. F. C. Bobby writes on "The Goat and Her Economic Uses to the Poultry Farmer"; while Mr. J. A. Caseby indicates five ways of making "Indirect Profits from Goats." The steps which are being taken towards "Improving the Stock" are outlined by Mr. S. Leigh Hunt. There are articles on goat-keeping in the Isle of Eigg (Scotland), in Ireland, Ceylon, South Africa, Kenya, and other parts of the Empire.

The scientific aspect is not neglected. Dr. Asdell, of the Animal Nutrition Institute at Cambridge, details the results of recent research in regard to the inheritance of colour, beard, and tassels; Mr. F. E. Corrie writes on "The Feeding of Goats," a subject which received some notice in the March number of this JOURNAL; and Dr. M. C. Clutterbuck a chapter on "Milk from a Chemist's Point of View."

English Farming, Past and Present. By Lord Ernle. (London: Longmans, Green & Co., Ltd., 1927. Fourth edition. xvi pp. + 506. Price 12s. 6d. net.)

To this new edition of the classical history of English farming, Lord Ernle has added a chapter on "Peace-time Farming, 1919-1927," and has, as far as possible, brought the appendices and statistical tables up to date. Doubtless conditions of printing and publishing made it impossible to make use of this opportunity for reconsidering other sections of the book: but before long it is to be hoped that the first three chapters in particular will be revised. As mediæval sources are explored and more intensively studied, our conception of the course of events is becoming radically changed. To take one instance. Lord Ernle accepts the view (pp. 64-5) that from 1349 to 1485 the yield of the soil had declined; but the most complete figures yet published, those taken from the Winchester manors by Sir William Beveridge,* certainly do not bear this out, and the point is really fundamental in any discussion of mediæval agriculture.

The last chapter, the new contribution which this edition provides for the student, is by the hand of one who has taken a large part in making modern agricultural history. It is hardly written *sine ira et studio*, nor perhaps could we expect an attitude of complete detachment. For its facts the reader will be grateful: of its underlying economic and political assumptions he would do well to beware. Many people

* "The Yield and Price of Corn in the Middle Ages," in *Economic Journal*: Economic History Series, No. 2.

would dispute Lord Ernle's assumptions violently and not perhaps altogether unreasonably. But to discuss them would be to introduce questions of political controversy which are foreign to this JOURNAL and in which the historian is handicapped.

Every serious student of agricultural history will welcome a new edition of a book which stands alone among all those that attempt to tell the story of English farming. To praise it would be superfluous.

* * * * * *

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Agriculture, General and Miscellaneous

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[The first edition of this work was reviewed in this JOURNAL for March, 1924. The book is divided into two parts. The first, dealing mainly with potato growing in America, contains chapters on influences in potato culture, crop rotation, varieties to grow, production costs, harvesting and marketing, storage, and diseases and pests and their control. The second part is concerned chiefly with the botany, breeding and selection of the variety. The book is well illustrated by photographs and text figures, and contains four coloured plates showing sprouted tubers and blossoms.]

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NOTES FOR THE MONTH

Report of the Intelligence Department, 1924-26

THE report of the work of the Intelligence Department for the two years 1924-26, just issued,* gives an account of the progress achieved in that period in the Ministry's schemes of research and advisory work, agricultural education, horticulture and live stock improvement. In presenting the report, Sir Daniel Hall expresses the hope that it shows that the resources which have been placed at the Ministry's disposal for such purposes have been economically used in the execution of a sound policy.

The period on the whole was one of consolidation, and the progress rendered possible by the provision of the Corn Repeal Fund in 1921 has been secured.

Research Institutes.—In this period the Institutes of Agricultural Engineering, at Oxford and of Animal Pathology at Cambridge were firmly established and have entered on what it is hoped will be long and distinguished careers. The Research Institutes may now be said to have reached a position of stability: the original scheme has been completed, and the research staffs, which expanded rapidly after the war, are in process of settling down. The crying need now is the provision of endowment funds. With the creation of the Empire Marketing Board and the convening of an Imperial Agricultural Research Conference for next October, prospects of organized influence and helpfulness throughout the Empire are opening before the Research Institutes, the primary concern of which, however, must always be the interests of the British farmer.

The maintenance grants paid to Research Institutes were £149,910 in 1926-27 compared with £147,450 in 1925-26 and

* *Ministry of Agriculture and Fisheries Report on the Work of the Intelligence Department of the Ministry for the Two Years* 1924-26. H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. 6d. net.

£134,710 in 1924-25. The capital grants in the two years totalled £10,700—a small sum compared with previous periods, the accommodation and equipment of the institutes now being reasonably complete.

Advisory Service.—In advisory work, the service of economic advisers in agriculture has been completed and now covers the whole country, and the number of assistants for dairy bacteriology—a staff designed for the improvement of the milk supply—has been largely augmented. The services of chemists, entomologists, and mycologists have been maintained at their full strength, and there are also a few advisory officers in veterinary science. A total of £57,820 was paid in grants to advisory centres in 1926-27 compared with £52,110 in 1925-26 and £41,670 in 1924-25.

Special Schemes of Research.—These schemes can be no more than mentioned in this short review. They relate to soil surveys, agricultural meteorology, crop variety testing, fruit variety testing, pig husbandry, new systems of farm management, electro-culture, basic slag, agricultural machinery testing, foot-and-mouth disease research, flax research, and field trials of Jerusalem artichokes.

Research Scholarships and Fellowships.—The scheme for selecting promising graduates (usually with first class honours in pure science) and training them in agricultural research in this country and abroad, to fit them for research and advisory posts, was continued, there being still a large demand for men. A similar scheme for securing recruits for the service of agricultural education was also continued. A number of travelling fellowships was again, in the period under review, awarded to agricultural research and advisory workers, to enable them to visit workers abroad and keep abreast of the progress of research in their own and allied subjects.

Agricultural Education.—The new buildings at Leeds and Bangor were practically completed during the period, and Liverpool University have been promised a grant towards an extension of their Veterinary Department on a £ for £ basis. The National Institute of Poultry Husbandry at the Harper Adams College of Agriculture was practically finished, and now constitutes the best experimental and instructional plant in this country. Two new farm institutes were opened (in East Sussex and Carmarthen), making a total of 16.

Maintenance grants totalling £49,100 in 1925-26 and £48,500 in 1924-25 were paid to universities and agricultural colleges; and annual grants totalling £210,000 (approximately) in

1925-26 and £177,000 in 1924-25 were paid to county authorities. The number of regular "higher agricultural education" students appears to have settled down at about 2,000. In the two years 1925 to 1927, the total number of whole-time instructors and instructresses employed by County Councils rose from 293 to 339.

An important change in administrative policy regarding agricultural education provided for younger students was introduced towards the end of the period under review. Previously, the Ministry's grants were limited to agricultural education intended for students above the age of 16, and the Board of Education were responsible for aiding such agricultural education as was provided for students below that age. During 1925, a revised arrangement was come to between the two Departments, under which instruction in agriculture for students between the ages of 14 and 16, outside that provided in elementary and secondary schools, will in future be aided by the Ministry.

Among special educational schemes supervised directly by the Ministry, mention should be made of the Young Farmers' Club Movement. An Inspector was appointed early in 1925 to take charge of this scheme, and through his efforts a considerable development has taken place. The Young Farmers' Club Movement attracts boys and girls at an age which is often a turning point in their lives; hence, the Ministry regards it as a valuable means of stimulating the young to an interest in a rural career.

Dairying and Small Live Stock.—One of the most noteworthy features in dairying education is the increased attention that is being given to the question of clean milk production. The number of clean milk competitions held increased from 7 in 1923-24 to 34 in 1925-26, and the number of competitors from 181 to 843.

The rationing of dairy cows provides one of the surest means of reducing the cost of milk production to the farmer. The conclusion of a Committee, set up by the Ministry, on the subject was that the general administration of a scheme of advice on rationing, uniform in its main principles, was both practicable and desirable, and a standard scheme was outlined which provided for the utilization of milk recording societies as extensively as possible.

It is the Ministry's policy to assist the development of the poultry industry mainly by facilitating the provision of instruction and advice by Local Education Authorities, and,

with the aid of grants from the Ministry, 53 County Authorities now employ expert Instructors for this purpose. Under the Egg-Distribution Scheme, operating in forty counties, there were, in 1926, 324 station-holders, and the total distribution of eggs was 132,169, and of chicks 68,252.

Scholarships.—The scheme of scholarships for the sons and daughters of agricultural workers has been successful. The experimental five-year period has just concluded and the Government has decided to continue the scheme in slightly amended form.

Horticulture.—Much work has been done in horticulture in the period under review, particularly in the direction of improving the marketing of fruit and vegetables by instruction and demonstrations in packing and grading.

As the result of action by the Ministry, the National Food Canning Council, comprising a number of tin-plate manufacturers, can makers, canners, and growers, was formed to promote the organization of food canning in co-operation with producers and distributors, so as to increase the quantity and consumption of home-grown produce. The Council proposes to endeavour to develop the home industry in every possible direction, so that it may the better compete with the products of the highly organized industries abroad.

The scheme for testing new varieties of fruit trees is progressing favourably, and many varieties of bush fruits have passed the initial tests at the Central Station at Wisley, and have been distributed to Sub-Stations for further trial.

Under the Destructive Insects and Pests Acts, Orders were made in 1924 and 1925 prohibiting the entry of potatoes from the United States and Canada on account of the prevalence of the Colorado Beetle in those countries. An order was also made in 1926 prohibiting the landing in England and Wales of raw cherries grown in France, unless accompanied by an official certificate that the Cherry Fruit Fly is not known to exist in the Department in which the fruit was grown.

The report on the administration of the Wart Disease of Potatoes Order of 1923 shows that the rate of spread of the disease has been materially checked.

Live Stock Improvement.—There was a very satisfactory measure of advance in the operations of the Live Stock Scheme during the period under review. Apart from the increase in the number of sires provided and the number of cows recorded under the Scheme, there has been a growing

interest in questions closely allied to breeding. The services and advice of the Ministry's Live Stock Officers and of the County Organizers are being increasingly sought in connexion with rationing, butter-fat testing, etc.*

The decline in the breeding of horses continued. Appreciable recovery was made, however, in regard to the operations of the Ministry's Heavy Horse Scheme which was revived in the season of 1924. Notwithstanding the somewhat serious position of the horse-breeding industry, it is satisfactory to note that the main object of the Horse Breeding Act, 1918, *viz.*, the elimination of the unsound travelling stallion, is being achieved in a very large measure. During the years under review, only five unlicensed stallions were reported on the road, and, in all cases, proceedings were instituted by the police.

Steady progress was maintained by the Milk-Recording Scheme, indicated not only by the steady increase in the number of members, but also by the improvement which has undoubtedly taken place in the manner in which records are being kept, and by the interest which members are taking in such matters as butter-fat tests and rationing. Another feature which is worthy of notice is the increasing stability of the societies operating under the scheme. In 1925-26, the number of samples taken for butter-fat tests was 108,000 compared with 72,000 two years previously.

In conclusion, in the volume recently published by the Ministry, *The Agricultural Output for England and Wales for* 1925, the total output of the land is estimated at 225 million pounds for that year. The State expenditure on agricultural education, research and allied activities may be taken in round figures at £700,000 per annum, *i.e.*, less than one-third of 1 per cent. of the agricultural output.

* * * * * *

Beet Sugar Campaign, 1926-27

THE last beet sugar manufacturing campaign was the most successful since the introduction of the subsidy. The acreage under beet was more than double that of the previous year and five additional factories were available to handle the crop. Increased experience in cultivation and the happy circumstance of a favourable growing season were reflected in a much larger production of sugar per acre of land under sugar beet.

* The Annual Report on the Live Stock Improvement Scheme for the year 1925-26, will be found on page 418 of August issue of the JOURNAL.

The general results of the campaign, compared with those of the previous one, may be summarized as follows :—

	1926 27	1925-26
Acreage under sugar beet..	129,463	56,243
Average yield per acre (tons)	8·63	7·67
Number of factories	14	9
Average No. of days worked*	114	87
No. of workers employed in factories ..	7,194	4,613
Tonnage of beets delivered to factories ..	1,117,072	431,185
Average sugar content of beets (per cent.)	17·31	16·36
Average price paid per ton of beet ..	59s. 5¾d.	55s. 6d.
Total production of sugar (cwt.) ..	3,069,739	1,035,672
Average extraction of sugar expressed as percentage of beets delivered to factories	13·83	12·01
Average farm output of sucrose per acre of beet grown (lb.)	3,346	2,809
Average factory output of commercial sugar per acre of beet grown (lb.) ..	2,656	2,063

Production of By-products: —	1926-27	1925-26
Molasses (cwt.)	715,886	270,910
Pulp (tons) Dry	62,800	21,795
Pulp (tons) Wet	26,138	31,481
Subsidy paid :—		
Sugar	£2,990,973	£1,009,019
Molasses	317,892	112,562
Total	£3,308,865	£1,121,581

* England and Wales only. To July 31, 1927.

N.B.—It should be remembered that the factories have to pay Excise Duty on the sugar they produce at the rate of 7s. 4⅝d. per cwt. (ex. 98 deg. polarization).

It will be noted that the production of dried beet pulp increased from 21,795 tons in 1925-26 to 62,800 tons in 1926-27, whilst the quantity of wet pulp fell from 31,481 tons to 26,138 tons. It may be added that the quantity of dried pulp exported rose from 4,657 tons in 1925-26 to 36,760 tons in 1926-27, being 21·4 per cent. and 58·6 per cent. respectively of the total output. Most of the pulp exported went to the U.S.A., where there would seem to be a ready market for this useful feeding stuff. In view of the heavy importations of feeding stuffs it is unfortunate that farmers in Great Britain have not made more use of this very valuable by-product rather than let it go out of the country. An account of the composition, nutritive value and uses of dried sugar beet pulp was given in this JOURNAL for May, 1927, p. 175.

Report of the Scottish Pig Industry Committee

ARISING out of a resolution passed at a meeting called by the Scottish Agricultural Organization Society on June 22, 1926, a special Committee was set up in Scotland, with Major Mark Sprot of Riddell as convener, to formulate a policy for the guidance of Scottish pig breeders and feeders.

It is of interest that the findings of the Committee, as set out in a Report issued on July 6, agree generally with the suggestions contained in the Ministry's Report on Pig Marketing.* The Scottish Committee, in their recommendations regarding breeding, are, however, even more restrictive than the trade associations in England and Wales, and for both the bacon and pork trades, recommend either (*a*) pure Large Whites of a suitable type, or (*b*) a first cross between a Large White boar and a Middle White sow. The Committee add, that a first cross between a Large White boar and a Large Black sow is also acceptable to a number of curers. It is significant that the Committee definitely recommend the Board of Agriculture for Scotland to restrict its premiums to boars of the Large White breed. It is also of interest to note that an experimental station for the testing of pigs, as part of a scheme of "advanced registry" on Swedish lines, is nearing completion at Liberton, Edinburgh.

Attention is drawn in the Report to the unsatisfactory position regarding price-recording of live pigs, and it is recommended that an effort should be made to secure a standard classification on the basis of that suggested in the Ministry's Report on Pig Marketing.

The Committee draw attention to the fact that curers complain of the miscellaneous character of "dealer-collected" consignments, and recommend the establishment of live-pig marketing societies on the lines of that operated by the Eastern Counties Farmers' Co-operative Association at Ipswich.

Finally, the Committee recommend that a standing body should be appointed to co-ordinate the development of the industry generally. This accords with the suggestion, made in the Ministry's report referred to above, that a Pig Industry Council should be set up in England and Wales.

* Economic Series, No. 12. H.M. Stationery Office. Price 6d., post free 8½d.

Marketing Demonstrations

IN the April issue of this JOURNAL was given a list of the centres at which marketing demonstrations were to be given by the Ministry this year. The summer programme, up to and including the Royal Welsh Show at Swansea (July 29-August 2), has now been completed. The nature and scope of the demonstrations have been fully described in the JOURNAL, and it is sufficient to say that they have aroused considerable interest and elicited many expressions of appreciation. It is significant that nearly 3,500 copies of the Economic Series of reports were sold at the demonstrations.

The revised programme for the autumn is as follows :—

Show or District	*Place*	*Date*	*Subjects to be demonstrated*
Shropshire ..	Shrewsbury ..	Sept. 27-28 ..	Eggs & poultry
Herefordshire ..	Hereford ..	Sept. 28-29 ..	Fruit
Worcestershire..	Pershore ..	Oct. 4-5 ..	Fruit
Gloucestershire..	Grange Court Market	Oct. 11-12 ..	Fruit
London Dairy Show	Agricultural Hall	Oct. 18-21 ..	Eggs & poultry; pigs
*Lincolnshire Potato Show	Spalding ..	Oct. 27.. ..	Potatoes
Imperial Fruit Show	Manchester ..	Oct. 28–Nov. 5	Fruit
*YorkPotatoShow	Doncaster ..	Nov. 8	Potatoes
*Durham Potato Show	Durham.. ..	Nov. 2 ..	Potatoes
Birmingham Fat Stock Show	Birmingham ..	Nov. 26–Dec. 1	Pigs
Smithfield Show	Agricultural Hall	Dec. 5-9 ..	Pigs; potatoes
West of England Show	Plymouth ..	Dec. 14-15 ..	Pigs

* Provisional.

* * * * * *

STRAWBERRY INVESTIGATIONS AT LONG ASHTON. 1.

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Introduction.—In recent years the yield of fruit obtained per acre by strawberry growers has in many cases been most unsatisfactory when compared with that obtained a number of years ago. It is frequently stated that where 2 to 4 tons to the acre used to be obtained the yield is now only 15 cwt. to 30 cwt. There were certain recognized diseases affecting the strawberry, *e.g.*, leaf spot, mildew, red plant and cauliflower. These, however, by no means entirely accounted for the serious reduction in yield. The other causes of failure were obscure.

Some suggestions have been made to account for this decrease in crop, *e.g.*, that in some cases the land was becoming "strawberry sick" owing to being continuously cropped with strawberries. Another suggestion was that the varieties at present in commercial cultivation were old, *i.e.*, had been propagated vegetatively for a large number of years and had deteriorated. A third possibility was that strawberries had become contaminated by some virus disease such as affects potatoes or tomatoes. Another very credible suggestion brought forward was as follows: During the Great War the acreage of strawberries had been considerably reduced; when hostilities ceased there was a rapid expansion of the area under strawberries and consequently the demand for runners was greater than the supply of really good material. The result of this was that a great deal of inferior material was used, and diseased and weakened stocks were greatly multiplied.

The need was apparent for a detailed knowledge of the life history of the strawberry plant and also for an investigation of the causes underlying the differences between one strain* and another. The former was required as a basis for any investigation of the pathology of the strawberry. Subsequent observations revealed the importance of the strawberry aphis

* In this article the word "strain" is used in its widest sense, no definite genetical variations being implied.

as a factor affecting the strawberry crop. It had been observed for some years, but no serious importance had been attached to its presence as a pest affecting the strawberry crop.

These considerations made it clear that any analysis of the various problems of strawberry growing must be preceded by a thorough investigation of the development of a normal healthy plant. This having been obtained, the influence of certain other factors such as methods of cultivation, strain and disease, can be assessed in their true relationships. For these reasons the following plan of investigations has been carried out at Long Ashton :—

I. The investigation of the life history of the normal strawberry plant.
II. The various effects of the following external factors on the development of the strawberry plant :—
  (1) Time of planting.
  (2) Methods of planting.
  (3) Methods and time of cultivation.
  (4) Mechanical damage to crowns and roots.
  (5) Deblossoming.
  (6) Climate and locality.
III. " Strain " investigations.
IV. " Red plant."
V. The strawberry aphis (*Capitophorus fragariæ*).
VI. Investigation of other types of abnormal strawberry plants.

In this paper, an account is given of the work which has been carried out on these subjects during the past three years, emphasis being laid on the practical importance of the results which have been obtained. References are given to articles in the *Journal of Pomology* and elsewhere in which detailed accounts of the investigations can be found.

The Life History of the Normal Strawberry Plant.—Field observations in the spring and summer of 1924 showed clearly the necessity of a more adequate knowledge of the normal development of a healthy strawberry plant from the date of planting through two or three consecutive seasons, and experiments were commenced by the writers in September, 1924. Some 1,200 plants of the variety " Royal Sovereign," obtained from a reliable source, were planted at Long Ashton on September 2, 1924. These plants have been carefully lifted, in batches of ten, at intervals of from three to six weeks, for the past two years. Detailed observations, both qualitative and quantitative, have been made which have been fully described and discussed in previous publications (4, 5, 9, 14).*

* The numbers in brackets refer to the bibliography at the end of the article.

It is proposed to present here a brief résumé of these results.

From the date of planting onwards, until the middle of December, there is a very marked growth of the root system in a normal healthy runner. Numerous new white roots arise from the crowns, and strong lateral roots develop on the main roots of the original runner root system (Fig. 1). During this period, little growth of the crowns occurs, and there is a gradual dying back of the foliage. In this condition, the dormant season is passed (Fig. 2).

During February internal changes, revealed by the quantitative results obtained, mark the recommencement of active growth. By the middle of March close examination of the root system shows that numerous fine lateral roots are beginning to appear. These roots have their origin on the strong autumn-formed roots and also on the original runner roots. Little change in shoot growth is observable at this date.

Towards the end of April, it is observed that very prolific production of new fibrous roots has taken place. These finer roots we have described as feeding "roots" and they form the most important absorbing organs of the plant. Few main roots are produced at this period, the chief activity of the root system as a whole being directed towards the establishment of an efficient absorbing surface by means of the development of numerous lateral roots on the main "scaffold" roots formed in the previous autumn. Shoot growth has advanced considerably by this date, and a normal plant shows three or four new leaves on each crown with, generally, a partially expanded flower truss.

During May and early June, there is very little change in the bulk of the root system, but a very pronounced colour change occurs. The older roots turn brown and finally black. This is not a death symptom but marks a definite phase in the normal development of the strawberry root. At the commencement of the growing season, a specialized circle of rapidly dividing cells arises just inside the central conducting cylinders of the main roots. This layer (the so-called phellogen or cork-cambium) divides rapidly, giving rise to a mixed secondary tissue within the white outer tissues (cortex) of the root. Certain definite circles of cells in this tissue are cork cells. As a consequence, the outer tissues of such roots, being cut off from water and food supplies by the secondary cork layer, commence to disintegrate. The progress of this disintegration is revealed by the colour changes from yellow

to brown and finally black. At the final blackened stage, the dead outer tissues may be readily removed, revealing the healthy central core of the root system protected by the secondary cork tissue. Meanwhile, growth of the "tops" has proceeded rapidly, and, by the first week in June, fully developed foliage and half-ripened fruits are present (Fig. 3).

Little further change in the root system is observable through the cropping season and before the middle of July. By this time it is generally possible to observe the commencement of a new phase in the development of the root system. To the right and left of the leaf bases of the earliest formed leaves new roots commence to make their appearance (Fig. 4). This marks the beginning of what we have termed the post-cropping stage of root growth, and it is of the utmost importance that everything possible be done to ensure this phase being vigorous. With reference to shoot growth, new foliage is produced and daughter crowns commence to develop, usually one on either side of the bases of the dying fruit stalks.

During August, a rapid advance in the development of the new roots observed in July occurs, and new roots are also produced at the bases of the daughter crowns. Shoot development has also advanced considerably (Fig. 5).

This vigorous development of the root system continues after shoot growth has ceased, and it is very probable that the chief factor arresting this vigorous development is that of decreasing soil temperature. Thus, when the second dormant season is reached in December (Fig. 6), a normal strawberry plant exhibits the following features:—

Root System.—(1) The original runner roots are much thickened and black, owing to the large development of secondary tissue. These roots are often much twisted and are furnished with strong lateral roots.

(2) Long, much-branched roots, formed in the period immediately after planting, are also much thickened and dark in colour.

(3) A few less vigorous, primary roots formed in the spring, are usually less thickened and yellow-brown in colour.

(4) Numerous long, white, primary roots of the post-cropping period arise from the main crown and daughter crowns and approximately one inch above the root system of the cropping period. This portion of the root system forms about one-half of the total bulk in a normal plant: a smaller proportion denotes impaired vigour.

Shoot System.—By this date, the foliage is for the most part dead or dying, and each crown possesses two or three small, deep green leaves.

In a general way, the sequence of root and shoot development in the second, and part of the third seasons, from the date of planting, is essentially the same as that described

above. Results obtained from subsequent observations on the same batch of plants confirm in all essentials those previously recorded, but certain features require special reference.

It was particularly observed during the course of the first year's observations that very little death of the roots occurred at any period during the season. Apart from decay of one or two runner roots damaged in planting, death of the roots was almost entirely confined to the very fine feeding roots produced during the spring, and this only occurred towards the end of the cropping season, when the development of the post-cropping, new roots had already commenced. At the same time, it was observed that the older roots, including the original runner roots, increased markedly in thickness. Similarly, in the second and third seasons, observations definitely established the fact that death of the main roots of a normal strawberry plant is exceptional. Thus, the root system of a normal three-year-old plant in the dormant season presents the following features: First, the very much thickened and twisted runner roots, with strong thickened branch roots, can be observed at the base of the old main rhizome or crown. Next, above these, the strong main roots formed in the first season immediately after planting are succeeded by a similar mass of thickened brown roots formed in the post-cropping period of the second season.

Microscopic examination of the internal structure of the older roots shows that the specialized secondary tissue previously described is very strongly developed (15). Not only does this tissue form a protective layer by virtue of the numerous circles of cork cells produced, but it also contains many cells packed with starch grains. Calculations made from numerous sections have shown that, approximately one-third of the volume of the older roots is composed of this specialized storage tissue. With the recommencement of root activity and growth, there is a rapid depletion of the reserves of starch contained in this storage tissue of the older roots.

The older roots of this type are, in turn, followed by a third series of vigorous new white primary roots arising from the bases of the numerous daughter crowns, and developed in the late summer and autumn following the second crop.

This detailed study of the life history of normal plants extending over the greater part of three consecutive seasons has revealed the following important features :—

(1) A very vigorous production of new roots occurs immediately after the planting of the runner.

(2) These roots form the framework on which is built up an efficient absorbing system of fine "feeding" roots which support the plant during the spring and early summer period when the crop is borne.

(3) The development of new main roots commences soon after cropping and continues until the dormant season is reached. Thus, the period of greatest root growth generally follows the period of most vigorous shoot growth.

(4) A similar cycle is followed in both the second and third seasons after planting.

The Distribution in the Soil of the Roots of a Normal Strawberry Plant.—The observations recorded in the foregoing section were made on plants carefully lifted and washed free of soil. Though valuable information was thus obtained on the features of root development and the amount of root growth, little could be learned of the actual position in the soil of the various types of roots. Accordingly, during the dormant season, plants were carefully lifted in boxes sufficiently large to accommodate the plants with the entire mass of soil penetrated by the roots and great care was taken to avoid disturbing this mass of soil in the course of removal to the laboratory. Successive sections of the soil mass from a depth of 16 in. up to the surface layers were carefully washed through a fine sieve so that all roots were thus recovered. The roots obtained from each region were separately measured and weighed. From the measurements taken, a diagram was constructed to show the distribution of these roots beneath the crown (Fig. 15). The relative proportions of the root system in successive layers of the soil from the surface to a depth of 16 in. were calculated from the weights of roots obtained. The relative quantities of roots from the successive layers is illustrated in Fig. 16.

Distribution of the Roots of a Normal Strawberry Plant in successive regions of the soil from the surface to a depth of 16 *in.*

Region	*Percentage of Total Roots in successive layers*		
Surface to 1 in.	25%	73% in first 3 in. of soil	90% in first 6 in. of soil
1 in. ,, 2 ,,	22%		
2 ,, ,, 3 ,,	26%		
3 ,, ,, 6 ,,	17%		
6 ,, ,, 9 ,,	2·5%	10% below the 6 in. level	
9 ,, ,,13 ,,	4·5%		
13 ,, ,,16 ,,	3%		

The figure constructed and the quantities quoted above show very strikingly the essentially surface-rooting habit of the strawberry plant. The writers fully realize that such factors as soil character and soil moisture may modify the distribution of roots considerably. The plants which yielded these results were grown at Long Ashton in a medium loam sufficiently

well drained, a type of soil commonly encountered in strawberry growing districts in this country. Observations on plants grown in soils of considerably lighter texture have shown that, though rooting is less restricted, the distribution of the roots is not essentially different from that described above.

In the diagram, roots developed in the post-cropping period are represented in lighter colour. It is observed that the bulk of these roots lie in the uppermost three inches of the soil. It should be almost unnecessary, therefore, to point out the prime importance of *disturbing the soil in the proximity of the plants as little as possible* after a thorough cultivation, carried out as soon as practicable after cropping. The earlier this cultivation is completed, the better will be the opportunity for vigorous rooting, with a consequently more vigorous and more productive plant in the following June.

The Various Effects of Some External Factors on the Development of the Strawberry Plant.—(1) *Time of Planting* (10).—Following the general planting of runners on September 2, 1924, a second small batch of runners was planted in October, and a further number was set out in the spring of 1925. Plants from these two groups, treated similarly with regard to general cultivation, were examined concurrently with those from the normal series. The runners planted in spring were deblossomed. In this preliminary experiment, the results showed clearly that delayed planting very seriously impaired the vigour of the resulting plants. When examined in May, the plants from the October series were no more vigorous than those set out in the spring and the plants of both series were much inferior to those from the normal September-planted series.

A more comprehensive experiment was designed for the season 1925-1926, as follows : Batches of normal, healthy runners, of a vigorous strain of the variety " Royal Sovereign," each batch consisting of 200 plants, were set out on the following dates :—

August series	Planted August 8, 1925.
September ,, ...	,, September 8, 1925.
October ,, ...	,, October 8, 1925.
December ,, ...	,, December, 18,1925.
Spring ,, ...	,, March, 18, 1926.

These plants were lifted at intervals and examined concurrently in the manner previously described for the normal series. Both qualitative and quantitative results were obtained which have been reported in full elsewhere (10, 14), and the main features of these results are summarized here.

The findings of the preliminary experiment, namely, that delayed planting resulted in reduced vigour, were amply confirmed. That early planting resulted in greatly increased vigour was very conclusively demonstrated by comparing plants of the August group with those of the September series. The normal sequence of vigorous root production in the period between planting and dormancy was followed in the first three series. Plants set out in December failed to develop new roots until the spring, when they appeared almost identical with plants from the spring series. This result serves to emphasize once more the great importance of the late summer and autumn phase of root production. There is no doubt that the performance of plants during the cropping season is determined to a very great extent by the vigour or otherwise of this root development. Plants set out in August reap a second important advantage. Previous work had shown that growth of the strawberry crowns continues until the end of September. If, therefore, runners are set out in early August not only is extra time gained for root establishment, but further development of crowns may also occur. In our experiments this was indeed the case, and, by the time the dormant season was reached, a typical plant of the August series possessed four strong crowns each with a considerable number of strong white primary roots. The plants of the later series were for the most part single crowned. At the commencement of the cropping season, the advantage of this early crown development became apparent, for each August plant produced from eight to ten strong flower trusses, as compared with two or three in the case of the September, and one in later planted runners (Figs. 9-12). In a general way, the August plants resembled average two-year-old plants rather than typical "maidens," and the fact that the *crop from these plants was almost four times that produced by the September series*, and proportionately greater than that from the October series, gives special significance to the resemblance.

The practical importance of these results may be summarized in a very few words, by stating that it is decidedly advantageous to plant out strawberry runners at the earliest possible date compatible with local conditions.

(2) *Methods of Planting* (11).—It has frequently been observed in the field that many weak plants often show very poor contact between the crowns and the soil, with consequently ill-developed root systems. Often on the crowns of

FIG. 1.—Photographed Oct. 13, 1924, six weeks from date of planting. The arrow indicates the position of the new primary roots developed since Sept. 2 of that year.

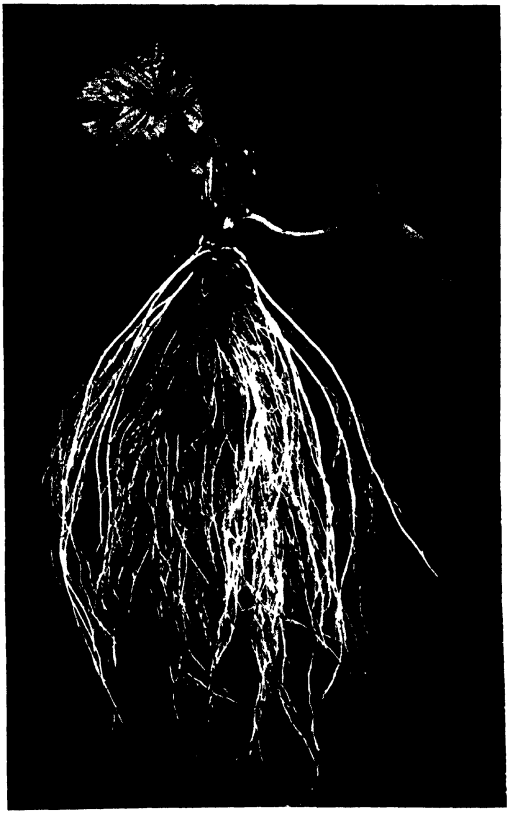

FIG. 2.—Showing the condition of the plant in the dormant season.

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FIG. 3.--Condition of the plant in the flowering season.

FIG. 4.—This photograph (July 20) shows the points of origin of the new roots which develop after the cropping season.

FIG. 5.—Condition of the plant twelve months after planting

FIG. 6.—Crowns and roots of a plant at the commencement of the dormant season of its second year. (December 1.)

FIG. 7.—March 16, 1926, growth recommenced. (Note the vigorous production of fine lateral roots.)

FIG. 8.—This photograph (taken Feb. 17, 1926) shows the quantities of new roots produced by runners planted in August, September, October and December, respectively, of the previous year.

FIGS. 9 and 10.—Time of planting experiment. Condition at blossoming period (April 27, 1926) of typical plants planted in August and September, respectively, of previous year. (See also Figs. 11 and 12.)

FIGS. 11 and 12.—Time of planting experiment. Condition at blossoming period (April 27, 1926) of typical plants planted in December, 1925, and in the Spring of 1926, respectively. (See also Figs. 9 and 10.)

FIG. 13.—"Miffy" plants (Type 1) produced by crown damage

FIG. 14.—"Small-leaf" (Type 2) produced by water-logging. The plant on the right is a control plant which has not been subjected to the water logging treatment. Variety: Stirling Castle.

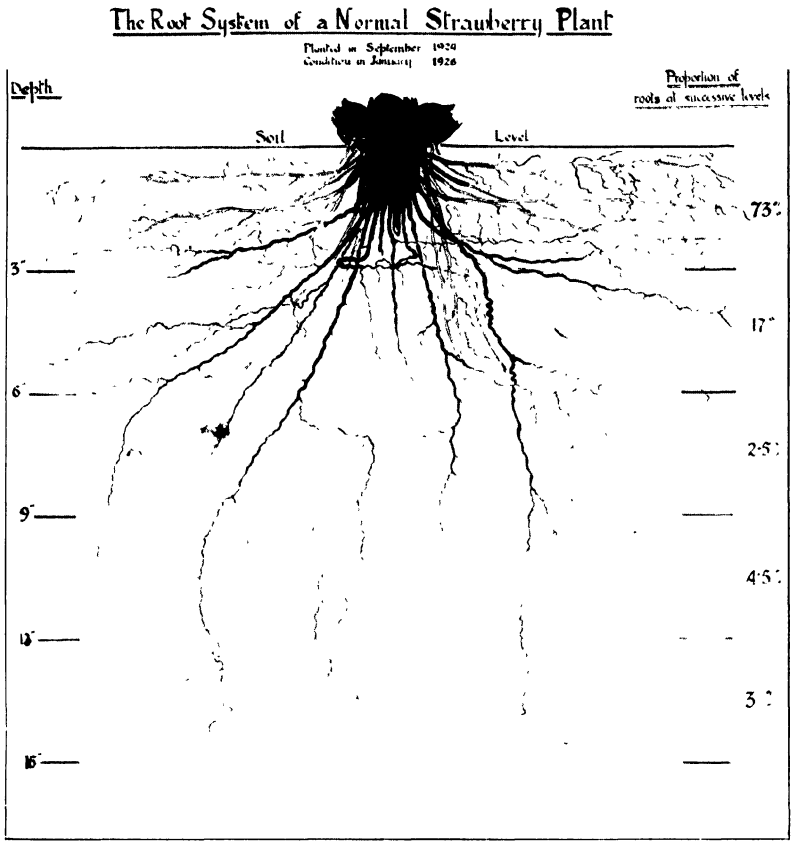

FIG. 15.—Root Distribution. Shows the distribution of the roots of a normal two-year-old strawberry plant in the soil.

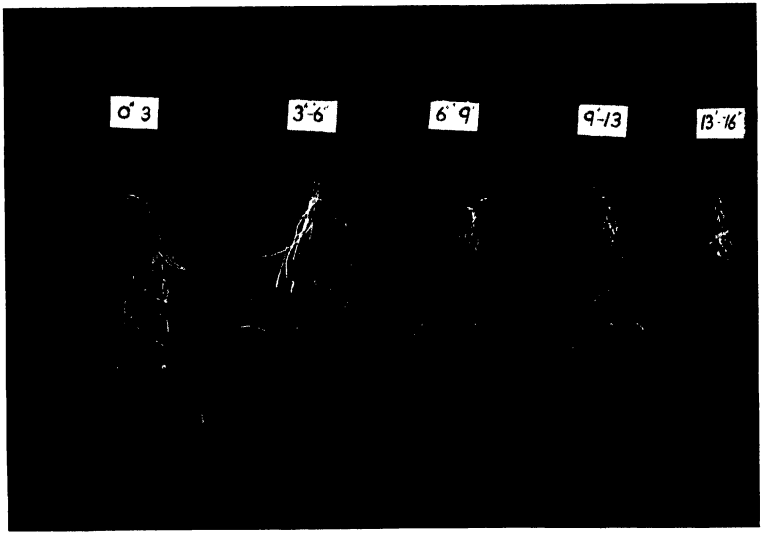

FIG. 16.—Illustrates the relative quantities of roots present in successive layers of the soil at the depths indicated.

such plants are found numerous stunted roots which have failed to reach soil level before the tips were killed by drying out. Experiments were commenced in order to discover whether planting methods had any influence on this condition. Batches of healthy runners were planted in September, 1924, and also in September, 1925, as follows :—

(*a*) Planted at normal depth with the soil level up to the leaf bases.
(*b*) Shallow planted with only the runner roots, to the base of the crown, below soil level.
(*c*) Deep planted, with the whole of the crown below soil level.
(*d*) Roots trimmed before planting. Approximately half the runner roots were cut off from the base and the plants set out at normal depth.

The above experiment has been twice repeated, and the following results have been obtained.

The effect of shallow planting was generally shown in a marked reduction in vigour. Root formation was decidedly poorer in this series than in any other. New roots, formed higher up on the crowns, failed to reach the soil and remained in a stunted, useless condition. The foliage produced by these plants was small and pale green, and there seems no doubt that such a condition is the direct result of inferior root development.

Deep planting caused abnormal lengthening of the crowns, but produced no serious ill-effects. There is, however, a tendency to cause damage to the main crowns by rotting when runners are planted so deep that the crowns are smothered with soil.

The root-trimming experiment was carried out to test under our conditions the advantage or otherwise of the current Canadian practice. As a result of cutting the main runner roots, vigorous strong lateral roots were produced near the cut ends within six weeks of planting. These roots grew out almost horizontally from the runner roots, forming an efficient anchoring root system. Such a development may be of considerable advantage, especially in lighter soils where there is a tendency for plants to "lift" as a result of frost. When plants of this series were examined along with normal plants one year after planting, they appeared to be neither better nor worse for the treatment.

To summarize, shallow planting is bad, since it leads to the production of weak plants with poorly developed root systems and frequently leads to a type of weak "small-leaf" plant later in the season. It is better to err on the side of deep planting, though losses may occur from smothering the crowns

with soil. Best results are obtained when the bases of the lower leaves mark the position of the soil level at planting.

(3) *Methods and Time of Cultivation.*—The ill-effects of shallow planting described above have shown the importance of maintaining good contact between the crowns and the soil. Frequently, in the course of cultivation, hoeing is necessary close to the plants. In this way, soil is removed from the neighbourhood of the crowns and, frequently, roots are disturbed and damaged. The longer cultivation is delayed, the greater is the resulting damage. From the knowledge of the normal distribution of the strawberry roots, it is obvious that disturbance of the soil in the proximity of the plants is bad practice. Further, as soil is scraped away, the chances of new root establishment are diminished and the net result is the production of a small-leaved weak plant. This result has been conclusively confirmed by experiment.

Conversely, experiments were carried out to discover whether any advantage was to be gained by "earthing-up" the plants slightly at various times during the season. It was found that slight earthing-up, the best time being in late July, had a markedly beneficial effect on the general vigour of the plants in the following season.

(4) *The Effects of Poor Drainage and Consequent Water-logging.*—In certain cases it was observed that plants growing in badly drained portions of a field showed a marked tendency to produce numerous weak crowns and small leaves. In such cases, the contact between soil and crowns was good, and it was therefore necessary to seek some other cause of the abnormality. Examination of the root systems showed that considerable death of the roots had occurred, especially of the finer lateral roots with their masses of fine feeding roots.

Root killing in these instances could not be attributed to any definite parasitic fungus, and it was decided to examine experimentally the effects of water-logging. Vigorous plants in large pots were grown in troughs containing water to within three inches of the soil surface. The experiment was commenced in April and within three weeks the ill-effects of water-logging were apparent. After flowering and fruiting the control plants were quite vigorous and healthy, but the water-logged plants showed abnormally small pale foliage and numerous weak crowns (Fig. 14). Examination of the roots showed that much death had occurred up to the level reached by the water, and subsequent root development had been very poor.

(5) *Mechanical Damage to Crowns and Roots.*—(*a*) *Damage to the Crowns.*—In the course of field observations in the spring, young plants were commonly observed to possess four or five very weak crowns instead of the normal strong single crown. Usually, these weak crowns produced imperfectly developed leaves, the stalks of which were often bright red in colour. Such plants may be confused at first sight with runners affected by the disease known as " red-plant " or " red-leg " (1, 3, 12). Subsequent observations on a large number of individual plants showed that, with increased growth, the weak crowns became normal, produced normal foliage and, in the following season, normal flowers. The whole plant, however, exhibited a bushy appearance unlike that of a perfectly normal specimen.

When plants of this type were examined at an early stage it was invariably found that the main crown had been damaged, or, for some other reason, had ceased to develop. Often the damage could be attributed to an accidental stroke with the hoe. As a result of this stoppage of the main growing point, four or five weak lateral buds in the axils of leaves, just below the point of damage, had started to grow rapidly, often before the embryo leaves in the buds had reached their normal stage of development. Thus, the first leaves were often forced into growth when only partially formed, but later in the season, true leaf form was attained. Damage of this nature frequently occurs to runners, and the multiple-crowned plant observed as a result in the spring is termed a " Miffy " plant by many strawberry growers (Fig. 13). Such plants may recover and make good two-year-olds, but bear no fruit in the first season. Many so-called " blind " plants are produced in this way.

The above observations have been fully confirmed by experiment. The main crowns of runner plants and also of plants in their second and third seasons have been cut off at different times during the year and subsequent development has been closely observed. By this means, the special features and the various stages of recovery outlined above have been exactly reproduced both with pot plants and in the field.

(*b*) *Damage to the Roots.*—Following experiments on the effects of shallow planting, hoeing the soil away from the plants and water-logging, it was decided to test the effect of mechanical damage to the roots. For this purpose, strong runners were planted in September, 1925, and batches of 25 plants were treated as follows. Using a knife with a long stiff blade, a complete circle approximately four

inches in diameter was described around each plant. The knife was plunged sufficiently deep into the soil to sever roots outside this region. Four batches of 25 plants were treated in this manner (*a*) in October, (*b*) in the dormant season, (*c*) in late spring, and (*d*) immediately after cropping. The plants treated in the dormant season and in the spring showed the greatest ill-effects from the treatment. These plants were much inferior in general vigour to the control series. The root system was much smaller, the crowns weaker, and the leaves markedly reduced in size. Plants damaged in October showed similar reduction in size and vigour, though to a less marked degree. Those plants treated after cropping showed no marked ill-effects from the damage.

The experiments show that damage to the roots, after the period of autumn root growth and before the cropping season, has a definite weakening effect and leads to the production of a type of inferior, small-leaved plant. The fact that little damage accrued from the treatment immediately after cropping would indicate that this is the most suitable time for the most thorough cultivation of the strawberry beds.

(6) *Deblossoming* (5).—It is a current practice in certain strawberry-growing centres of Great Britain* to plant runners extensively in the spring. Such plants are deblossomed during the first season and carry their first crop some fifteen months after planting. Underlying this practice is the belief that a runner set out in spring is not sufficiently well established to support a crop during the following summer. A study of the normal sequence of root and shoot development has fully confirmed this view, and further experiments have proved that the general vigour of plants is considerably increased when deblossoming is carried out. Plants set out at various dates from September to the spring have been treated in this way with the constant result of improvement of vigour from deblossoming.

For this reason, the practice is advisable in the case of weak plants. The same treatment may often be recommended in the case of the runner bed where the object is to produce first-class runner material. In this instance, since the large

* It is frequently the case that winter conditions are too adverse for runners set out in the autumn and losses are too heavy to render practicable such planting. It is suggested, however, if planting were possible at an early date in August that by the time winter conditions were reached, the strong, well-developed August-planted runner would be sufficiently well established to withstand the rigours of winter.

food reserves are not drawn upon to nourish a developing crop, more energy is available for the production of vigorous vegetative shoots, including runners.

(7) *Climate and Locality* (10).—Work on this subject has not yet advanced very far, but some information has been obtained. In September, 1925, runners of the variety "Royal Sovereign" were planted at Hoveton, Norfolk, and it has been possible to examine batches of these plants concurrently with batches of plants of the same age and variety planted at Long Ashton in September, 1925.* The Hoveton soil is a much lighter alluvial soil than that at Long Ashton. The average yearly rainfall at the two centres is respectively 26·48 in. and 34·88 in.

The comparative observations so far made show that plants at both centres exhibited precisely similar phases of normal root and shoot growth, following closely the sequence of normal development previously described. The Hoveton plants showed a more rapid and abundant production of roots in the autumn, a feature connected with the lighter texture of the soil, which is known to allow of free root development. In all other respects, differences were of a very minor order.

Plants were set out at Hoveton as the conditions in Norfolk offered a considerable contrast to those at Long Ashton. It therefore appears unlikely that local conditions can modify to any serious extent the normal sequence of root and crown development carefully worked out at this Station.

(*To be concluded.*)

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(15) C. E. T. Mann: "The Origin, Development, and Function of the Roots of the Cultivated Strawberry (*Fragaria vesca virginiana*)." (In the press.)

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HERBAGE SEED PRODUCTION IN NEW ZEALAND:

IV—PERENNIAL RYE-GRASS AND CRESTED DOGSTAIL

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Perennial Rye-grass.—An altogether larger acreage is devoted to the production of the seed of perennial rye-grass than of any other herbage species in New Zealand. Before 1914, the acreage annually cut was about 50,000, the total crop frequently exceeding 8,000 tons. During the period 1916-18, the area increased to over 70,000 acres and then decreased, but in 1924-25 it had risen to over 66,000 acres, with a total yield exceeding 13,000 tons of seed. By far the largest amount of the crop is used for home consumption; in 1924-25, the total export was only 1,152 tons, 906 tons of which went to Australia. The amount of New Zealand perennial rye-grass reaching the European market is negligible and, consequently, the interest to the British farmer is only in connexion with the general practices adopted with reference to seed production and the relation of those practices to the quality of the seed and to the character of the strains which the seed represents.

Seed Production in Relation to Farm Practice and Habitat.—Perennial rye-grass is, to a far greater extent than red clover, definitely relied upon as a seed-producing crop in many

districts of New Zealand. That is to say, the harvesting of a seed crop will not depend upon a variety of contingencies, but rye-grass seed, equally with wheat, is regarded as a crop to be produced and turned to cash account every year. Thus, on most Canterbury farms, the main lines of production are fat lambs, perennial rye-grass seed, and wheat. The leys are therefore sown, as much with a view to seed production, as to the herbaceous keep that they will provide for farm stock. The harvesting of a seed crop from leys is chiefly practised in the Canterbury Plains, in Southland, and, to some extent, in Otago, in the South Island; also in the Sandon district of the North Island. Perennial rye-grass is also harvested in limited amount from quite old swards in the North Island, particularly in the Poverty Bay and Hawke Bay districts.

Harvesting Practices: *Canterbury Plains.*—The rye-grass is frequently sown in leys with red clover, when the seed crop is usually taken in the second harvest year. It is, however, often the practice to sow rye-grass in the autumn and to take a seed crop the following summer (= first harvest year). The paddocks are shut up for seed in the middle of September. It is a fairly common practice, when rye-grass is growing with red clover, to turn a comparatively large head of sheep for a restricted grazing period into the seed-producing paddock, about two-three weeks before cutting the crop, as the sheep will eat down the clovers (which, as explained in a previous article, are usually abundant in the second and even the third year) without harming the rye-grass. The crop is cut with a self-binder when dead ripe, despite the risk of shedding, is stooked in the field for about 10-14 days, and is invariably thrashed from the stook, and it is the feasibility of doing this that is largely responsible for the profitable production of rye-grass seed. The straw after thrashing has a fair feeding value and is altogether more relished by stock than that of Italian rye-grass. Hair-grass (*Festuca bromoides*) is a plentiful and troublesome weed.

Seed crops are not infrequently taken from leys that have been down to grass from three-four years; the seed is then taken with a stripper, when it is essential that the crop should be dead ripe.

Southland.—The Southland farming resembles that of the Canterbury Plains, except that oats take the place of wheat in the rotation. The rye-grass may be sown in a mixture of the general type, 20-40 lb. perennial rye-grass, 5 lb. cocksfoot,

1 lb. crested dogstail, and 1 lb. white clover, seed crops being taken in the second and third harvest years. Rye-grass is, however, not infrequently sown in the autumn (April) and a seed crop taken the following (= first harvest) year.

In the seed-producing districts of the South Island, oats and rye-grass are sometimes sown together in the autumn (April), the two species being harvested together for seed the following December—that is to say, a seed crop is taken within about eight months of sowing.

Sandon.—The rye-grass leys are almost invariably spring-sown in this district, and are then fed off during the autumn and winter, a seed crop being taken in the first and, sometimes, again in the second harvest year. The crop is cut with a self-binder and, as elsewhere in New Zealand, thrashed from the stook—normally only standing about 14 days, but in adverse seasons the stooks have been known to stand on the paddocks for nearly two months. The rye-grass straw after thrashing is often sold to local dairymen for £4 per ton.

Yellow suckling clover is generally abundant on the rye-grass leys, over 40 lb. of suckling clover seed sometimes being cleaned from an acre of rye-grass. New Zealand suckling clover, thus cleaned from the perennial rye-grass, finds its way to an appreciable extent on to the European market.

Yield.—The average yield of seed from New Zealand, as a whole, runs to about 400-600 lb. per acre, but yields of well over 800 lb. are frequently recorded. The bushel weight of dressed seed is usually high, ranging from 26 to 36 lb.

Strain in Relation to Methods of Seed Production.—It will have been noted that the methods of seed production allow from as short a period as eight months in sward to two or three years, and, in extreme cases, to upwards of twenty years. It used to be claimed for Poverty Bay seed that it was always harvested from old swards and, in the past, much of the Sandon rye-grass came originally from Poverty Bay old swards. At the present time it would seem probable that much of the seed harvested from the Hawke Bay and Poverty Bay districts is not necessarily taken from old swards, while the Sandon growers are perhaps not going to these districts as much as formerly for a change of seed. It yet remains true that there are certain broad distinctions between "Poverty Bay," "Sandon," and "Southern" rye-grass. It is a well-recognized fact that "Southern" rye-grass tends to contain a much higher percentage of Italian rye-grass than does

either Sandon or Poverty Bay. It is also a fact that Southern rye-grass gives a fine "bold" sample of high viability. The considerable practice of autumn sowing, followed by taking a seed crop in the first harvest year, inevitably tends to constitute a selection not only in favour of Italian rye-grass but also of the quicker growing and more short-lived strains of perennial rye-grass; particularly so, if this practice is followed year after year without change of seed. Comparative trials at the Welsh Plant Breeding Station have shown that these "Southern" rye-grasses do, in fact, contain an excess of strains of a stemmy and early type which, in comparison with British indigenous strains, and with ordinary Irish and Ayrshire commercial strains, do not render "New Zealand" rye-grass an attractive commodity.

Lots under test, received as "Poverty Bay," have, in no case, compared favourably, in respect of the characteristics of the plants produced, with plants derived from seed representing the cleanings of wild white clover from old British swards—but the different lots have varied very considerably. Many of the "Poverty Bay" samples have given rise to a certain proportion of plants having the characteristics of density and leafiness which betoken the harvesting of seed from swards that have been down to grass for a period of years rather than months.

It is significant in New Zealand that both "Sandon" and "Poverty Bay" seed command a higher price than "Southern," but it is equally significant, having regard to the varied practices of seed production adopted in that country as a whole, that samples of "New Zealand" rye-grass tested at Aberystwyth have, in general, shown a greater mixing and a greater variety of strains per lot than is usual in the case of seed obtained from other and ordinary commercial channels.

As both the seed merchant and the farmer now look, very rightly and properly, for long-lived strains of herbage plants, and also consider germination and purity in relation to strain, and further, in view of the fact that New Zealand cocksfoot does definitely constitute a long-lived strain, and that much of the New Zealand white clover is also satisfactory in this respect, it is appropriate to voice a word of warning in respect of New Zealand perennial rye-grass.

It is more than probable, indeed practically certain, that in New Zealand there are excellent long-lived strains that could be harvested and marketed as such if the necessary

precautions were taken. It remains a fact, however, that no single lot of ordinary commercial New Zealand seed that has been tested at Aberystwyth (whether designated "Poverty Bay" or "Sandon") has approximated in average leafiness and desirability to the lots of British "ex-wild white" under contemporaneous test.

It is to be hoped, therefore, that "Poverty Bay" rye-grass will not begin to find its way on to the British market as a cheaper substitute for our own "ex-wild white"—or at all events will not do so until complete tests in this country, with properly authenticated lots of seed, have fully justified such a procedure.

Crested Dogstail.—Before 1914, it was only occasionally that New Zealand produced more crested dogstail seed than was required for home consumption, namely, about 150 tons per annum. In more recent years, the area devoted to seed production has increased, and, in 1921-22, was as much as 6,713 acres, with an output of over 600 tons. The area has subsequently decreased and would seem now to stand normally at about 2,000 acres, but frequently over 100 tons of seed are available for export, this surplus mostly coming to the United Kingdom, though much of it may be re-exported. It will be seen, therefore, that New Zealand is not infrequently an appreciable source of supply for crested dogstail retailed to the British farmer.

Seed-Producing Districts.—Crested Dogstail has been grown for seed for many years in the Sandon district of the North Island, but more recently this has been taken up extensively in the neighbourhood of Gore, in Southland, where far more seed is now harvested than in the North Island.

Gore.—Here the usual practice is to broadcast 16-20 lb. of crested dogstail seed with the turnips sown in the spring. A seed crop is sometimes taken in the first harvest year, but perhaps more usually in the second harvest year. The crop is cut with the self-binder, the average height of the stand being about 18 inches, and, under favourable conditions, remains about three weeks in stook and is thrashed from the stook. Stacking is not practised unless unavoidable.

A number of farmers in this district will annually harvest about 80 acres. The yields of dressed seed are frequently decidedly high, and may exceed 500 lb., but the average would be about 250 lb. Seed is also taken from older leys, when the fields are only shut up for about a month or six weeks; this seed is taken with a stripper and includes a

fair amount of perennial rye-grass. The yields run to about 100 lb. to 140 lb.

The chief weed seeds taken with crested dogstail are the Canada (= creeping) thistle, sheep's sorrel, and Yorkshire fog. The crested dogstail leys have the reputation of making excellent and very healthy sheep-grazing, and lambs are reported to fatten excellently upon them.

Sandon.—Temporary grass farming, with the production of both perennial rye-grass and crested dogstail for seed, is the feature of this district. On a 600-acre farm, it would be expected to work round the whole area in about seven years, the chief crops being grass, turnips, and rape. It is usual to sow about 20 lb. of crested dogstail alone or with oats in April; after harvesting the oats, a perfect stand of dogstail will be attained. The following year, the field will be shut up in October or November and harvested in January. It is the usual practice to leave in stook up to three weeks and to thrash from the stook; yields of from 350-400 lb. are expected.

The seed is also stripped from older leys. The strippings are put into bags, which are half filled; two bags are tied together and left open hung over a fence for the purpose of drying the seeds. *Linum marginale* is a common impurity in the seed of dogstail from this district; it may be present to the extent of 1 to 3 per cent., but is easily removed and is said to have a value for use in the manufacture of proprietary feeding stuffs.

As in the Gore district, the leys are held in high esteem for fatting lambs. Crested dogstail leys will not maintain a clean, pure herbage for more than about two years, if a seed crop is taken in the first harvest year, but they will become over-run with weeds and sweet vernal grass. Largely on this account the production of seed is not as popular as formerly, since it necessitates maintaining special short duration leys. The whole tendency in New Zealand to-day—a natural outcome of the excellent results obtained by the use of phosphatic manures (chiefly superphosphate)—is to depend less on the plough and more on top dressing and, consequently, much to extend the duration of the leys.

Quality of Seed in Relation to District.—Crested dogstail is one of those species which tend to drop in germination during ocean transit or if retained long in store. This appears to be intimately connected with the degree of maturity of the seed when harvested. A bright yellow sample of seed is always

esteemed; this association of brightness with presumed excellence is, indeed, a striking example of one of those seed characteristics which have come to have a trade value for no good reason and without the backing of any reliable tests or evidence for its justification.

The bright yellow colour in crested dogstail is an outcome of too early cutting and of premature ripening off in stook, a state of affairs much aggravated by particularly dry conditions at harvesting time. This practice is common in the Gore district, the seed of that district having a considerable reputation for its brightness.

The Sandon seed is usually not cut so early, is far better matured and, consequently, takes on a richer brown colour, which, in fact, betokens excellence and high viability, and implies an ability better to withstand prolonged storage or prolonged transit.

This matter of colour is important in relation to the import trade, for, if a rich dark brown were to become the criterion of excellence, demanded alike by farmers and seed merchants in this country, it would immediately react on the harvesting methods adopted in the South Island of New Zealand and, therefore, upon the viability of the seed reaching our shores from the Dominion. There is little doubt that the different species of herbage plants require very different conditions in which to mature and ripen their seed, in order to attain to maximum viability and in order to maintain vitality for the greatest possible length of time under other than the most favourable conditions. Mr. Nelson Foy, of the Department of Agriculture at Wellington, gave his opinion to the writer that dogstail, and to some extent cocksfoot also, both require a "damp" harvest, while rye-grass, to reach high excellence as seed *qua* seed, must have dry, hot conditions. The whole question is one of the first importance, and one that needs to be subjected to critical examination.

It is useless to investigate loss of germination in transit or during storage unless the whole cycle of maturing and harvesting has also been under study. This is now thoroughly recognized in New Zealand, and investigations in progress may be expected to throw considerable light on a number of difficult problems connected with the harvesting and handling of herbage seeds.

Strain.—Investigations conducted at Aberystwyth with seed from Ireland and New Zealand, and with that collected from old pastures in England and Wales, although showing

interesting strain-differences in respect of dogstail, have not revealed such striking and important economic differences as in the cases of perennial rye-grass, cocksfoot, timothy, and red and white clover. It is probable, therefore, that, in point of strain, it makes relatively little difference what nationality of crested dogstail seed is sown. This is the more probable in view of the fact that crested dogstail, undoubtedly, very largely maintains itself on our grasslands by means of repeated and abundant self-seeding and self-establishment.

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NOTES ON TWO FUNGICIDES: SULPHUR AND BORDEAUX MIXTURE

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"Wettable Sulphur."—As is well known through practice, sulphur kills those fungi known as "powdery mildews." Used dry in powder form, it has proved a cheap and reliable remedy against "mould" in hops, the mildews of the strawberry, rose, etc., and is in common use for this purpose. It not infrequently happens that crops which are affected with mildew suffer at the same time from damage caused by insects, and require, therefore, spraying with some insecticide, in which event a simultaneous application of sulphur and the insecticide is called for. In some cases, the need is met by using a dissolved compound of sulphur, such as "lime-sulphur" (calcium polysulphides) or "liver of sulphur" (potassium polysulphides), which can be mixed with the insecticide. In other cases, however, it is still advisable to use the sulphur in powder form, to avoid any injury being caused by the polysulphide solutions to the delicate parts of the plant sprayed. The question then arises of how to obtain an intimate mixture of sulphur powder with a wet spray.

It is common knowledge that it is impossible to mix sulphur powder with water, as it remains, even after the most vigorous stirring, on the surface. The use of soap as a medium for wetting sulphur appears to have been first proposed in 1910, by Vermorel and Dantony. They recommend* that sublimed sulphur be mixed with 1 per cent. soap solution and 1 per cent. sodium carbonate. As soap cannot be used satisfactorily when such spray-fluids as Bordeaux mixture, lime-sulphur, lead-arsenate, etc., are used, it was later recommended by the

* *Comptes Rendus*, Vol. 151, p. 1146 (1910).

same authors* that the sulphur should be moistened with an alcoholic solution of oleic acid, for sulphur so treated could at once be wetted with water. Alcohol alone suffices to make sulphur "wettable," but, when the alcohol evaporates, the sulphur again becomes unwettable. If, however, a small amount of oleic acid is incorporated with the sulphur, the latter retains the property of being easily wetted by water or spray-fluids. W. O. Gloyer,† in 1915, reported, from the results of experiments in the control of a stem-rot and leaf-spot of Clematis, caused by the fungus *Ascochyta clematidina*, that "a mixture of 1 lb. laundry soap and 6 lb. of sulphur to 15 gall. water" proved successful. It was also used with success in the control of leaf-blotch, *Diplocarpon rosae*, on roses grown in the forcing houses.

In order to obtain information as to the best, easiest and cheapest way of rendering sulphur wettable, a number of trials were carried out in the laboratory, in which the following substances were used: soft soap at various strengths, alcohol with and without oleic acid, oleic acid alone, casein in various forms, and glue. The practical points to which attention was directed were (*a*) ease of wetting; (*b*) the manner in which the sulphur remained in suspension; (*c*) the extent to which dilution could be carried out. It is not necessary to enter into details concerning the results which were obtained in the above trials, for it was found that a 1 per cent. solution of soft soap (10 lb. to 100 gal. of ordinary tap water of a hardness of 18°) proved most satisfactory in rendering the sulphur wettable, and that, with the water in question, dilution to ¼ per cent. of soap was possible without any separation of the sulphur.

Various brands of sublimed sulphur and ground sulphur were tested; all of them settled to the bottom of the vessel rather rapidly and could only be kept in suspension by constant agitation. Fine dusting sulphur, about 90 per cent. of which passed a 200-mesh sieve, was the most satisfactory sample tested, but the best commercial brands of sublimed sulphur and ground sulphur also gave satisfactory results. Tests, in which the various brands of sulphur were compared, showed that the sulphur remained in suspension in the case of the diluted soap solution as satisfactorily as in any other case except lime-casein (calcium caseinate), but, as the latter is much more troublesome in mixing, it is not recommended.

* *l.c.*: Vol. 153, p. 194 (1911).

† New York Agric. Exper. Station *Bull.* 44 (1915).

The addition of nicotine, at the rate of 6 oz. per 100 gal. to the sulphur, wetted with soap solution and with the other preparations—oleic acid and calcium caseinate—gave no indication of any change, and, consequently, the use of nicotine with wetted sulphur can be recommended for trial.

Biological Experiments.—During June, 1926, experiments* were carried out, in an unheated greenhouse, with hop plants infested with "mould" (*Sphaerotheca Humuli*). Marked leaves bearing a number of patches of the mildew, densely powdery with the accumulation of spores (*conidia*), were sprayed with a thick suspension of sulphur, previously treated with oleic acid, in a 1 per cent. solution of soft soap.†

The mixture was sprayed on in a very fine mist, using an atomizer. The container of the atomizer was well shaken each time before the application of the spray. No difficulty was found in getting the suspension to pass the extremely fine aperture of the nozzle. Unsprayed leaves at the same node, bearing similar patches of mildew, served as "controls." By the next day after spraying, all or most of the upright branches (*conidiophores*) of the mildew, as well as the chains of spores which they bear, were seen to be collapsed; no further growth of the mildew took place, the patches remaining sterile until the end of the experiment (11 to 14 days). The same satisfactory results were obtained when a mixture of the same amount of sulphur (with no oleic acid) and $\frac{1}{2}$ per cent. of soft soap was used. The rapid collapse of the mildew was in striking contrast with the effect observable when sulphur in powder form (sublimed or finely ground sulphur) is dusted on a patch of mildew. Dry sulphur causes no immediate collapse of the upright spore-bearing branches, which are only slowly affected at the relatively few places where the particles of sulphur touch the fungus—a fact on which further observations will be found below. The explanation of the difference of action is probably due to the fact that, in the fluid wash,

* The full details of these experiments will be published elsewhere.

† The brands of sulphur used were those known on the market as Brandram's "flowers of sulphur" (sublimed sulphur), Fortress Brand of Hop Sulphur (ground sulphur), and Monro's Dry Dusting Sulphur. The suspension was made by wetting 100 grammes of sulphur moistened with 4 c c. methylated spirit and 1 c.c. oleic acid, and of this treated sulphur, 5 grammes were taken and added to 100 c.c. of 1 per cent. soft soap solution. Attention is called to the fact that this amount of sulphur—equivalent to $\frac{1}{4}$ lb. sulphur to the gallon—is not sprayed on to the plant, as a considerable proportion remains behind as a deposit. The amount of deposit varies according to the thoroughness of the agitation.

particles of sulphur are carried to all the parts of the fungus that are wetted, whereas only the surfaces of mildew patches are touched by the dry sulphur. Some observations which were made on hop leaves in the open, which were sprayed with the wettable sulphur, made as described above, incline us to believe that the sulphur particles remaining on the surface of the leaf, after the wash has dried, are less liable to be washed off by rain or dew than when sulphur is applied dry.

The sulphur particles suspended in the wash settle rapidly, as already pointed out, and constant agitation is required to maintain the suspension at the nozzle. It remains to be seen whether the agitation provided in the ordinary knapsack sprayer and in the horse-drawn hop-washer will be sufficient. The simultaneous application of sulphur and of an *aphis*-killing wash (nicotine, with or without soft soap) will, it is believed, prove feasible, and it is intended to carry out field experiments on these lines in the coming season.

Since it is the practice of some of the most successful hop-growers to apply sulphur in powder form to the hop plants when they are in flower (or, as the growers say, in "burr"), it was important to ascertain whether the application of a wash, containing wetted sulphur, would affect injuriously the flowers or the production of the hop cones. On August 6, 1926, a number of opposite lateral branches, which were in full "burr," on plants in the Experimental Hop-garden at Wye College, were selected, and one branch was heavily sprayed, an atomizer being used, with the wetted sulphur and soft soap solution described above, while the other branch was left unsprayed and served as a control. No injury resulted from the spraying, and, by the end of the month, it was found that the development of the cones on the sprayed and unsprayed branches was the same.

"*Flowers of Sulphur*" (*Sublimed Sulphur*) *and Ground Sulphur*.—In a previous communication to this JOURNAL,* one of the writers, when pointing out that sulphur is effective in controlling hop "mould" (*Sphaerotheca Humuli*), recommended for the purpose pure sublimed sulphur ("flowers of sulphur")—the statement being made "that flowers of sulphur remains the one safe and reliable remedy." This statement now requires modification. Within recent years, the use of improved machinery and the adoption of special apparatus have resulted in the manufacture of ground roll

* E. S. Salmon. This JOURNAL, XXVIII, p.157 (1921).

or brimstone sulphur which, in the case of good samples, is not inferior, in fineness and purity, to the best "flowers of sulphur."

During 1926, some experiments were carried out to compare the efficacy of sublimed sulphur and ground sulphur as fungicides against hop "mould." The method of applying the sulphur was as follows: a test-tube, 5 in. long and $\frac{9}{16}$ in. bore, was half-filled with the sulphur and its mouth covered with fine muslin. Sufficient sulphur was shaken out in a fine cloud to cover completely the powdery patches of mildew on hop leaves attached to a growing plant.

The first experiment was made on March 18, when similar patches of mildew, on two young leaves at the same node on the stem of a young hop plant, were treated with sublimed sulphur and the finest ground sulphur respectively. On April 1, 14 days after the application, the two leaves were removed and examined under the microscope. The fungicidal action of the two kinds of sulphur was the same. Wherever any particle of sulphur had touched the chains of spores borne on the upright branches (*conidiophores*) the former were shrivelled and dead, although the conidiophore below the chain of spores was uninjured; where, however, as at the edge of the leaf, no sulphur had touched the mildew, the latter was still vigorous and producing chains of spores. The sulphur was then removed as far as possible by washing the leaves; in the hollows near the veins of the leaves, the mildew had been protected from contact with the sulphur and was unaffected; elsewhere, the sulphur had killed the tallest branches (*conidiophores*) and their chains of spores, while the shorter, sheltered ones, not having touched the sulphur, were unaffected. There were no signs that the mycelial hyphae had been affected.

The second experiment, using the same two kinds of sulphur, was made on March 25, on two leaves at the same node, each bearing several large powdery patches of mildew. On April 27, 33 days after the application, the effect of the two sulphurs was exactly similar; where the sulphur had touched them, the chains of spores had all shrivelled, although here and there a young conidiophore with a short chain of spores occurred which was unaffected. The hyphae of the mycelium on the surface of the leaf were white and apparently unaffected.

In the third experiment, the same brands of sulphur were used, air-dry and after having been passed through a 160-

mesh sieve. The powders were applied, in the same manner as before, on May 19. On June 11, 23 days after the application, the mildew patches were still completely covered by the two powders; when the surplus was shaken off from some of the patches, these still seemed, to the eye, well covered by the sulphur. Under the microscope, fine hyphae of the mycelium could be seen radiating from the edges of each patch. There was no evidence that any of the mycelium was dead. Although the chains of spores were shrivelled and dead where contact with the sulphur particles had occurred, fresh conidiophores were appearing in the intervening spaces between the particles. By June 16, 28 days after the application, the remaining patches, still completely covered by the sulphur, were alive and showed young living hyphae at the circumference; intermingled with dead and shrivelled chains of spores were young conidiophores pushing up, with, very occasionally, a mature spore at the tip. It was evident that if the sulphur were removed—such as might result from the action of heavy rains—the mildew patches would be able to renew their growth and produce spores. No difference in action between sublimed sulphur and ground sulphur was observable.

It would appear from the results of the above experiments that, while sulphur in powder form does effectively stop the dispersal of spores of the mildew and thereby checks the spread of the disease, it is very slow in fungicidal action, and there is always the risk that it may be removed by heavy rains. Even when sulphur remained undisturbed for a month on the mildew patches, the fungus, under the conditions of the experiment, was not killed. Since the fungicidal action appears to be identical in both cases, the hop-grower can be advised to use either sublimed sulphur or special ground sulphur of equal fineness and purity.

In view of the slowness of action of sulphur when applied as a dust, the fluid wash of wetted sulphur (described above), with its much quicker fungicidal action, merits a trial against hop "mould" and other "powdery mildews."

Home-made Bordeaux Mixture.—The fungicide known as Bordeaux mixture (made by mixing together copper sulphate solution ["bluestone"] and milk of lime) is second to none in preventing many of the plant diseases caused by fungi. In all countries, it has been in use, for many years past, by the progressive farmer who realizes the benefits which it brings. The best method of making Bordeaux mixture has been given

in articles in this JOURNAL, in 1908 and again in 1910.* These articles may be consulted for detailed information both as to the making of stock solutions of copper sulphate and of lime, and for the proper application of the mixture. In the agricultural literature of every country, the results of numerous experiments have been published which show that Bordeaux mixture may confidently be relied upon to prevent the attacks of most fungi on cultivated crops. To take one instance, Bordeaux mixture effectively controls the "scab" or "black spot" of the apple, as recent articles in this JOURNAL have shown.†

Satisfactory results, obtained by the use of home-made Bordeaux mixture against other fungus diseases, have also been recorded.‡

The difficulty which is often experienced in obtaining, at short notice, small quantities of good freshly burnt quicklime, suitable for making Bordeaux mixture, has undoubtedly been one reason why many growers have not used this spray or have chosen a manufactured article.§ Moreover, quicklime does not retain its properties under the usual conditions of storage, so that the grower has to obtain fresh supplies each time he wishes to spray. As is well known, quicklime becomes hydrated by absorption of moisture and then combines with the carbon dioxide of the air to form carbonate of lime, which is worthless for making Bordeaux mixture. When quicklime is slaked with water, the hydrate of lime is produced, and it is this substance that combines with the copper sulphate to produce the well-known gelatinous blue precipitate, characteristic of properly made Bordeaux mixture. It is true that, as pointed out in 1910,|| perfectly satisfactory stock solutions of lime can be made with little trouble, but the farmer who shows the necessary enterprise, to have at hand stock solutions

* E. S. Salmon: "Apple Scab" or "Black Spot" (this JOURNAL, XV, 191 (1908); "The Making and Application of Bordeaux Mixture" (*l.c.*, XVI, 793 (1910).

† N. B. Bagenal, W. Goodwin, E. S. Salmon and W. M. Ware: "Spraying Experiments against Apple Scab" (*l.c.*, XXII, 137 (1925); XXXIII, 38 (1926).

‡ E. S. Salmon: "Cherry Leaf Scorch" (*l.c.*, XIV, 334 (1907); *Idem:* "Potato Spraying for Farmers" (*l.c.*, XXIV, 265 (1917); *Idem* and H. Wormald: "Potato Spraying Experiments" (*l.c.*, XXVI, 71, 269 (1919).

§ Experience both in this country and abroad has shown that home-made Bordeaux mixture is superior in fungicidal qualities to the ready-made preparation in paste or powder form.

|| This JOURNAL, XVI, 793 (1910).

of the ingredients to make Bordeaux mixture, remains, unfortunately, the rare exception.

The object of the present communication is to call attention to a variation in the method of making Bordeaux mixture, which consists in the use of slaked lime (calcium hydrate or hydrate of lime) in the place of quicklime (calcium oxide). Hydrate of lime is now prepared in a high degree of purity on a commercial scale, and, by its use, a simplification of the method of making Bordeaux mixture becomes possible. Comparative laboratory experiments made at Wye showed that the appearance and nature of the precipitate, as well as the rate of settling, were almost identical in the case of Bordeaux mixture made with quicklime and hydrate of lime, respectively, up to the end of 6½ hours; after longer periods the differences were only slight. On theoretical grounds, there seems to be no objection to the employment of hydrate of lime, for this is the product which is obtained in the milk of lime which, having been prepared by adding water to quicklime, is ordinarily used for the preparation of Bordeaux mixture. The advantages which can be obtained by using commercial hydrate of lime are (1) a high degree of purity; (2) a product which can be stored for comparatively long periods without becoming seriously changed; (3) a more rapid preparation of the spray fluid, as no time is lost in slaking the quicklime.

Hydrate of lime is obtainable on the English market in the form of a fine white, dry powder, and good commercial samples contain not less than 95 per cent. of hydrate; when packed fresh in closed paper-lined bags, it does not become carbonated at all rapidly. The proper packing is essential, for, unless this is done, the hydrate changes to carbonate, and there are no indications (as is the case with lumps of quicklime, which fall to a powder and so show that some change has taken place) to call attention to material which is no longer fresh and suitable for making Bordeaux mixture. As 1·32 parts by weight of hydrate of lime are equal to 1 part of oxide of lime, it is necessary to modify the proportions of copper sulphate and lime when the hydrate is used. A safe rule is to take 1½ pounds of the hydrate in place of 1 pound of quicklime, the usual formula for Bordeaux mixture, 8.8.100 thus becoming 8.12.100. The cost of the hydrate of lime will, of necessity, be somewhat higher than that of quicklime, especially if the latter can be obtained locally; but the advantages offered by the former are that it is a high-grade

product of uniform composition and, if kept closed in paper-lined bags, it does not change on storage. If the use of hydrate of lime becomes general, no doubt supplies will be obtainable in paper-lined bags of various sizes; at present, 56 lb. is the usual weight. The price of hydrate of lime, on rail at the works, is about £2 per ton, in four-ton lots, bags extra. It will be understood that hydrate of lime, even when packed in closed paper-lined bags, will not keep indefinitely, but from trials which were made last season it was found that it remained in a satisfactory condition from the time of the first spraying (April 17) to the last (June 19). The hydrate, when stored in closed metal containers, was fit for use after a lapse of nine months. It is recommended, however, that fresh supplies should be obtained for each season's spraying.

Reference to technical literature shows that in America hydrate of lime (slaked lime) has been in use for some time for making Bordeaux mixture. In a few cases, an adverse report has been given. Thus, Butler, in 1914, stated* that "hydrated lime does not produce as fine a milk of lime, all things equal, as quicklime, and the results [of experiments] show that this lack of fineness unmistakably increases the rate of settlement of the mixtures prepared with it. The use of hydrated lime, in lieu of quicklime, is not, therefore, to be recommended, except perhaps in the rare instances when the latter is not obtainable, or is of too poor quality to be advantageously used." In 1923, Martin carried out experiments in spraying potatoes against early blight (*Macrosporium Solani*), in which comparison was made of Bordeaux mixtures prepared from quicklime and from hydrated lime. This author states† that "it is apparent that the use of stone lime for making Bordeaux mixture is to be advised over that of hydrated lime. Where the former is difficult to secure, however, the hydrated lime may be substituted." In 1924, Newton, in reporting the results of spraying experiments against apple "scab," stated,‡ "The use of hydrated lime in Bordeaux mixture appeared to produce very much more severe russeting of the fruit than was caused by rock lime." Chupp, in his *Manual of Vegetable-Garden Diseases* (1925), states that "hydrated lime, if

* O. Butler: in New Hampshire Agric. Exper. Station *Circ.* No. 15 (May, 1914).

† W. H. Martin: "Ten Years of Potato Spraying in New Jersey," New Jersey Agric. Exper. Station *Bull.*, 383 (1923).

‡ Newton, F. W.: in *Trans. Illinois State Hort. Soc.*, LVII, 165 (1924).

fresh, may be employed if lump lime cannot be obtained, although Bordeaux mixture made of it does not stay in suspension quite as long as does that made from the burnt lime."

On the other hand, by far the greater number of experimenters report favourably on the use of hydrated lime in the preparation of Bordeaux mixture. Thus, Fields and Elliott, in 1920, stated* that "the hydrated lime Bordeaux mixture compared favourably with the mixture made from freshly slaked lime." In 1923, Winston, Bowman and Yothers reported† that "in general effectiveness Bordeaux mixture made with hydrated lime has proved throughout the experiments to be equal to that made with quicklime." Ballou and Lewis, in 1923, in Ohio, found‡ that a satisfactory control of apple "scab" was obtained by Bordeaux mixtures of various strengths, in which three pounds of high-grade hydrated lime were used for every pound of copper sulphate. Anderson, also, in 1924, in Illinois, in reporting on experiments in spraying apples against "scab," stated§ that Bordeaux mixture made with hydrated lime gave as good control and caused no more injury than Bordeaux mixture made from rock lime. In the *Spraying Programs for the Orchard and Fruit-Garden*, published by the Ohio Agricultural Experiment Station in 1920 and in 1922, the use of hydrate of lime is recommended.‖ Further references to authors advocating the use of hydrated lime are given below.¶

* W. S. Fields and J. A. Elliott: in Univ. Arkansas Agric. Exper. Station *Bull.*, 172 (1920).

† J. R. Winston, J. J. Bowman, and W. W. Yothers: United States Dept. Agric. *Bull.*, 1178 (1923).

‡ F. H. Ballou and I. P. Lewis: in Ohio Agric. Exper. Station *Monthly Bull.*, VIII, 3-4, p. 42 (1923).

§ H. W. Anderson: in *Trans. Illinois State Hort. Soc.*, LVII, 165 (1923).

‖ *Monthly Bull.*, Ohio Agric. Exper. Station, V, No. 3, 70 (1920); VII, 1 and 2, 19 (1922).

¶ Green, Selby and Gossard, in Ohio Agric. Exper. Station *Bull.*, 309 (1917); Halligan, Pettit and Coons, in *Sixty-First Annual Report*, State Board Agric., Michigan, 423 (1923); Robinson, in Oregon Agric. College Exper. Station *Bull.*, 201 (1924); Coons and Kotila, in *Sixty-Third Annual Report*, State Board Agric., Michigan, 505 (1925); Dutton, Pettit, Bennett and Cardinell, in Michigan Agric. College Agric. Exper. Station *Special Bull.*, 140 (1925); Dodge and Wilcox, in U.S. Dept. Agric. Farmers' *Bull.*, 1488 (1926); Young, Houser and Ballou, in Ohio Agric. Exper. Station *Bull.*, 393 (1926); and Manuel, in Australia, *Agric. Gaz.*, N.S. Wales, XXXIII, 759 (1922).

Robinson has recommended,* in the making of Bordeaux mixture with hydrated lime, the addition of 0·01 casein. The proportionate amount to be taken of hydrated lime as compared with quicklime is given by the various authorities quoted above (usually) as $1\frac{1}{2}$ lb. to 1 lb., although the ratios $1\frac{1}{3}$ to 1 and $1\frac{3}{4}$ to 1 are also given.

A comparative trial of Bordeaux mixtures made with quicklime and with hydrated lime, respectively, was carried out at Wye during 1926. Eight pounds of copper sulphate to 100 gal of water were used, and 8 and 12 pounds, respectively, of quicklime and hydrated lime. The latter was gradually mixed to a thin cream with cold water, and then diluted fully with the requisite amount of water before the concentrated copper sulphate solution (at the rate of 1 lb. of copper sulphate to 1 gal. of water) was poured into it. The same method of mixing was followed in making the Bordeaux mixture with quicklime. The two mixtures were sprayed on to an equal number of apple trees, of the varieties Newton Wonder and Allington Pippin, in a plantation on Wye College Farm. Three applications, using a fine, "misty" spray, were given; the first (at the "pink-bud" stage) on April 17; the second and third on May 21 and June 19. It was found that the Bordeaux mixture made with the hydrate of lime adhered to the foliage as well as that made with quicklime. Owing to a failure of the crop on the trees, the results of the spraying on the control of "scab" on the fruit could not be ascertained. It was observed, however, that the two Bordeaux mixtures controlled to a marked and equal extent the attacks of the fungus on the leaves, while causing no appreciable "scorching" injury. As early as May 29, many of the leaves on the "control" (unsprayed) plots showed so severe an infestation that they were becoming "sooty" with the growth of the fungus, while the foliage of the sprayed trees was practically free from attack. This control of the "scab" on the leaves of both Newton Wonder and Allington Pippin was continued right through the season, while the disease continued to develop on the unsprayed plots.

If, as seems likely to be the case, Bordeaux mixture made with hydrate of lime proves equal in fungicidal powers to that made with quicklime, a demand will grow up for the two constituents of the mixture prepared in convenient form. If weighed amounts of copper sulphate and of hydrate of lime are sent out by the manufacturers, with suitable instructions

* R. H. Robinson: in *Indus. and Eng. Chem.*, XV, 941 (1923).

for mixing, the making of home-made Bordeaux mixture on farms in this country may yet become as common as it should be.

Summary.—(1) A method is described of making a fluid wash of " wetted " sulphur, with or without soft soap.

(2) Experiments, carried out in 1926, showed that a suspension of sulphur in a solution of soft soap kills the " powdery mildew " of the hop (*Sphaerotheca Humuli*). The fungicidal action of the sulphur in this wash was observed to be far more rapid and complete than when sulphur was applied in powder form.

(3) Finely ground sulphur was found to be equal in fungicidal power (against the hop " powdery mildew ") to sublimed sulphur.

(4) A method is described of making Bordeaux mixture with hydrate of lime in the place of quicklime.

(5) Preliminary experiments, made in 1926, showed that Bordeaux mixtures made with hydrate of lime and quicklime, respectively, controlled to an equal extent the attacks of " scab " (*Venturia inaequalis*) on the foliage of apple trees (Newton Wonder and Allington Pippin), and did not cause any " scorching " injury.

* * * * * *

BRITISH FINCHES: THEIR ECONOMIC STATUS

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THE Finches and Buntings form a well-defined family; some of them are among our commonest birds. None of them attains any great size—the Hawfinch is the largest member of the family—and, as they are all to a great extent seed eaters, they possess more powerful bills than their relatives, the warblers, which live mainly on insects and other soft food. There is, however, considerable variation in this respect even among the Finches, *e.g.*, between the powerful stone crushing bill of the Hawfinch and the comparatively weak pointed bill of the Chaffinch or Goldfinch,

but, generally speaking, a strong bill, with a tendency to a conical shape, is characteristic of the Finches. It is not proposed to deal here with the rarer species of the family, but only with those which are present in fair numbers and whose economic influence is appreciable.

(1) **The Hawfinch,** *Coccothraustes c. coccothraustes* (L.).—This is a large and striking-looking bird, and, to one who has only seen a stuffed specimen on the shelves of a museum, might be expected to be very conspicuous. It is local in its distribution, and there are large areas in England and Wales where it is hardly ever seen. If we except the almost negligible fraction of ornithologists and students of wild nature, the vast majority of country folk never see a Hawfinch from one year's end to another, except at too great a distance to be recognizable, even in those districts where the bird is comparatively common. There are, however, certain signs by which the presence of the bird in the summer months can readily be detected. Thus, if there is reason to suspect the presence of Hawfinches, it is well to keep an eye on any yew trees in the neighbourhood when the berries are ripe. Note may be made as to whether fresh clippings are lying on the ground, as if a gardener had trimmed off the outlying shoots some few inches long and left them lying there. If there is none it is unlikely that there are Hawfinches about, but, if there are, they should be examined to discover whether they have held berries. If this is the case and no gardener has trimmed the trees, it is safe to infer that the birds are in the habit of coming there to feed, cutting off the twigs with their powerful bills to get at the berries. If the tree is approached quietly when there is no one about, probably, before long, at perhaps the second or third attempt, one will be aware of a bird flying out with a hurried, bustling flight, but always on the far side of the tree, so that one only catches a glimpse of it.

Another test of the presence of Hawfinches is to watch the rows of green peas in the kitchen garden, and here the evidence of the gardener may prove useful. Jays, Hawfinches, Sparrows, and to some extent Tits, will all do damage to green peas. The Jay is a large and conspicuous species, and likes to have plantations and woods close at hand; the destructive work may be done in the early hours of the morning, but it should not take long to detect this culprit. Sparrows set about their task with plenty of chattering, and generally in company,

so they are very easily spotted; while the Great Tit has to go through a slow process of boring to get at the peas and does not play havoc with the row like the other thieves. If the damage is extensive and the pods are completely wrecked, with no evidence of Jays or Sparrows, one probably has to deal with the Hawfinch, and careful watching should soon enable one to surprise him engaged in his work. Cherry trees have an irresistible attraction for the Hawfinch, not so much on account of the fruit, but, what is just as bad for the grower, for the kernel of the stone. Single trees will be visited day after day, until every cherry has been cleared off, and a well-hidden watcher will hear the crack of the stones as they are cracked with the greatest ease by the birds. It might seem a hard task for a small bird to smash a cherry stone with its bill, but if the heavy conical bill of a dead Hawfinch be forced open, the ridged grasping surface seen within will leave no doubt. Still more convincing proof can be obtained by handling a winged bird incautiously, while even a nestling can draw blood at quite an early age.

As may be imagined from the above paragraphs, the Hawfinch is no favourite with the gardener, yet on the whole, except for the two crops mentioned, it does little damage. Unless cherries are grown, it becomes simply a matter of keeping it from the peas, though no doubt some of the smaller stone fruit trees, such as the damson or bullace, are visited at times. As far as the writer is aware no volumetric analysis of its food has yet been made, but there is little doubt that, though some birds are destructive to peas and are kept away with difficulty, the great majority come under the heading of indifferent, their food being almost entirely obtained from such trees as the hawthorn, yew, bird-cherry, and, to a lesser extent, beech, blackthorn, laurel, sycamore, and maple. Against their misdeeds in the garden and orchard, must be estimated a certain amount of positive good done by the destruction of injurious insects, such as the larva of the currant moth in the spring.

The shy and secretive habits of the bird also tend to prevent it from visiting small or exposed gardens, and it is only likely to be a nuisance in large, old-fashioned gardens, with big yew hedges and adjacent woodlands or old timber. On one occasion no fewer than four occupied nests of this species were found in a little patch of orchard, hardly more than a rood in extent, close to a garden of this character, all in lichen-covered fruit trees and from 8 to 15 feet from the ground.

If the birds are troublesome in an old garden, it generally pays to look round the fruit trees for nests, especially if the trees are much overgrown with lichens. A favourite site for the nest is on a more or less horizontal branch, at no great height from the ground, where it can be detected by the fringe of dead twigs which form the foundation of the nest and are visible on each side of the supporting branch. The eggs are easily recognized with their greenish blue ground and bold streaks and scrawls of black.

A curious characteristic of the species is the way in which, after being common in a district for years, it will, without any apparent reason, desert it altogether. Economically, it only becomes important in districts where stone fruits are largely grown, such as the Kent and Worcester orchards. Where the Flemish cherry is grown, nothing but shooting is effective in protecting the crop. Peas are more easily protected and are more readily watched, while the signs of damage can at once be detected. In other respects, it is practically harmless.

(2) **The Greenfinch,** *Chloris c. chloris* (L.).—This is a much more familiar species than the Hawfinch, and most country dwellers are familiar with the yellow-green plumage, while those who are acquainted with bird songs know only too well the monotonous drawling note of the male and the interminable twittering notes of the nestlings. It has none of the shyness or the secretive instinct of the Hawfinch and breeds freely in hedgerows and in shrubberies or gardens, so that it is easily recognized.

Though the bill of the Greenfinch is strong, it is not built on the massive lines of the Hawfinch, is almost entirely a seed eater, and does not interfere with fruit crops. It is said to destroy blossom occasionally, but not to any great extent, and in the orchard its presence may usually be ignored, although Theobald speaks of the damage done in this way as being serious. The only accusation of injury done to fruit is that of picking seeds from ripe strawberries in Kent (L. H. Page), but the habit does not appear to be general and no other instances of it have come to the writer's knowledge.

In arable country and gardens, however, the Greenfinch is a different proposition, and, owing to its numbers, it may at times become very troublesome. Freshly-sown garden seeds are a temptation to these birds, and, as several

birds are often to be seen together on the beds, they soon produce definite effects. In gardens where the surface to be protected is small, they can be kept off by thread entanglements and similar devices, but it is a more serious matter when a large flock descends upon a field of newly-sown turnips or corn. Hooper records a case when a field of milled sainfoin had to be ploughed up because most of the seed had been taken by Greenfinches. The amount of grain taken in corn-growing districts where the bird is abundant must be considerable, even though the quantity taken by individual birds is small, and it does not descend on ripe cornfields in such flocks as the Sparrows do. The staple food throughout the year of this species consists of the seeds of weeds of many kinds. From the examination of 42 adult birds W. E. Collinge records the seeds of seven species, *viz.*, mouse-ear and common chickweed, charlock, common sorrel, curled dock, ribwort and corn marigold (*The Food of Some British Wild Birds*, p. 83), while C. F. Archibald, in addition to charlock, dock and corn marigold, also mentions dandelion, plantain, goose-grass, corn crow-foot, knot-grass and wild vetch.

Collinge has secured interesting results by sowing the faeces of these birds on sterilized soil. From 38 droppings thus treated 52 plants were raised belonging to seven species—charlock (4), curled dock (12), ribwort (3), dandelion (6), knotweed (9), goose-grass (5), and corn marigold (13). From this it is clear that the destruction of weed seeds is by no means complete or an unmixed benefit.

Florence's summary of 166 cases shows that 133 contained cereals and 76 seeds, while insects were only found in 9 cases and a spider in one. The very small proportion of animal matter is noteworthy: only a few beetles (including the turnip flea beetle (*Phyllotreta*) and various weevils), aphides, and winged ants have been recorded from adults. Even in the nestlings, Collinge only found remains of insects in 19 cases out of 28: these consisted chiefly of small caterpillars (19), and small flies (16), together with three spiders. Evidently the young are fed largely on masses of unripe or sprouting seeds. H. B. Knox has taken a mass of food of this kind from one bird's crop, which filled a large teaspoon, yet only one larva was contained in it. Lepidoptera (moths) are also said to be occasionally fed to the young, and the late M. C. H. Bird has known them fed with the seeds of the Scotch pine. C. H. Hooper states that, in the hop-growing districts, this bird is very destructive to the blossoms, which it pulls to

pieces in order to get at the seeds, so that, when the birds are present in numbers, the ground is littered with the flower bracts.

To summarize: on grasslands and in dairy-farming districts the Greenfinch is quite harmless except to the young seeds in the kitchen garden, and this can be guarded against. In arable and corn-producing areas, though far less destructive than the Sparrow, it must do considerable damage, and its numbers should be kept down, while it is a serious nuisance in the hopfield and to the market gardener. In the fruit-growing districts, the harm done is almost negligible.

(To be continued.)

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COUNTY EGG-LAYING TRIALS

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SINGLE bird, egg-laying tests, open to poultry-keepers in Cheshire, have been held at the Cheshire School of Agriculture during the past two years, each test commencing in the middle of October and extending over a period of 48 weeks.

Details of the Trials.—Two sections have been provided: (*a*) Heavy Breed Pullets; (*b*) Light Breed Pullets. The flocks have been housed under identical conditions in two, three-quarter-span-roof laying-houses of 50-bird capacity, each provided with a quarter-acre grass run. The eggs have been graded and scored under the new system advocated by the Ministry of Agriculture, *viz.*:—

Special Grade.—Eggs of normal shape and shell, weighing: 2 oz. and over during first four weeks; 2 1/16 oz. and over during second four weeks; 2 1/8 oz. and over during remainder of test.

First Grade.—1 7/8 oz. and over, but under 2 oz., during first four weeks; 1 15/16 oz. and over, but under 2 1/16 oz., during second four weeks; 2 oz. and over, but under 2 1/8 oz., during remainder of test.

Second Grade.—1 5/8 oz. and over, but under 1 7/8 oz., during first four weeks; 1 15/16 oz. and over, but under 1 15/16 oz., during second four weeks; 1 3/4 oz. and over, but under 2 oz., during remainder of test.

No limits were set to the number of second-grade eggs allowed to score: all double-yolked eggs were included in this grade. No points were given for eggs below second grade in weight, or eggs which, owing to abnormal shape, or imperfect

shell, were obviously unfit for incubation. Such eggs were, however, recorded separately and are included in the figures of total eggs laid.

Period	Points for each Egg: Special grade	First grade	Second grade	
First four weeks.. ..	11	10	8	Oct.-Nov.
Second ,, ...	13	12	10	Nov.-Dec.
Third ,, ...	11	10	8	Dec.-Jan.
Fourth ,, ...	9	8	6	Jan.-Feb.
Fifth ,, ...	8	7	5	Feb.-Mar.
Sixth ,, ...	6	5	3	March
Seventh ,, ...	6	5	3	April
Eighth ,, ...	6	5	3	Apl.-May
Ninth ,, ...	6	5	3	May-June
Tenth ,, ...	7	6	4	June-July
Eleventh ,, ...	7	6	4	July-Aug.
Twelfth ,, ...	8	7	5	Aug.-Sep.

The entries received were as follows :—

	1924-25	1925-26
Heavy breeds ..	52 birds from 35 flocks	57 birds from 38 flocks
Light breeds ..	41 ,, ,, 28 ,,	37 ,, ,, 24 ,,

Prizes and Certificates.—Gold, silver, and bronze medals have been awarded for the three birds scoring highest points in each section ; and Certificates of Merit for all birds laying 180 first and special grade eggs.

Quality of Birds.—On the whole, birds sent to the tests have been of good quality, though a number which had been in lay too long and a few immature pullets were received in both years. The numbers of birds which had not commenced to lay by given dates were as follows :—

	1924-25	1925-26
At end of first month ..	26 birds—28 per cent.	27—28·7 per cent.
,, ,, second ,, ..	19 ,, —20·4 ,,	11—11·7 ,,
,, ,, third ,, ..	6 ,, — 6·5 ,,	4— 4·3 ,,

Health and Mortality.—The general health of the stock throughout the tests was excellent. In 1924-25, a few slight colds appeared in the third month, but these quickly responded to treatment ; no deaths occurred until the eighth month. Altogether six birds were lost, four of the deaths being due to troubles connected with the egg organs. In 1925-26, six deaths occurred, five of which were due to ovarian disorders.

Feeding.—In both tests, grain was fed twice daily, early in the morning and at noon, and wet mash every afternoon (except on Sundays, when an extra feed of grain was given).

The standard wet mash mixture was made up as follows :—

Bran	25-30 per cent.
Thirds	35-40 ,,
Sussex ground oats	10-15 ,,
Maize meal	10-15 ,,
Meat meal	10-15 ,,

The exact composition of the mixture was varied slightly from time to time in accordance with seasonal changes and the condition of the birds.

Dry mash hoppers were kept filled throughout the tests, and limestone grit was provided as required. During the autumns, marrow-stem kale was given almost daily. The total food consumed was as follows :—

	1924-25	1925-26
Grain	3,830 lb.	4,257 lb.
Meal in wet mash	3,175 ,,	3,803½ ,,
Meal in dry mash	734 ,,	694¼ ,,
Total	7,739 ,,	8,754¾ ,,

The average consumption of meal and grain was therefore 4 ounces per bird per day in 1924-25, and 4·5 ounces in 1925-26. It is interesting to note the very decided preference for wet mash displayed.

Observations on the Results.—Tests of this description furnish interesting evidence on a number of points in connexion with egg production. The records suffer, it is true, from the disadvantages attaching to relatively small numbers ; but, on the other hand, the birds were kept under carefully controlled conditions ; they were drawn from a large number of flocks and were probably not related one to another ; their performances were, therefore, much more likely to represent the average of good flocks than would the records of larger numbers on a single station. In an ordinary flock, it is difficult to obtain many birds which are unrelated for half a dozen or more generations back. There is little likelihood in tests such as these that any particular strain will colour the average results to any appreciable extent. Moreover, the error attaching to the results can in most cases be measured by mathematical means.

Egg Yield, Food Consumption, and Value of Eggs.—All eggs produced during the tests were sold, ungraded, at the wholesale rates current from week to week in the public market at Nantwich.

The following table gives for each year the average figures per bird for the two flocks, the general average per bird per month, and the average prices of eggs.

TABLE I

Month	Food consumed	Egg Yield		General average	Value of eggs (pence)	Av. price of eggs per doz.
		Heavy breeds	Light breeds			
1924-5	lb.					s. d.
Oct.-Nov. . .	6·2	8·9	11·9	10·2	31·5	3 2½
Nov.-Dec. . .	6·7	10·2	10·9	10·5	34·1	3 3
Dec.-Jan. . .	6·9	13·1	13·1	13·1	35·4	2 9½
Jan.-Feb. . .	6·9	12·5	13·0	12·8	32·5	2 6½
Feb.-Mar. . .	6·6	15·7	17·7	16·6	32·5	1 11½
March . .	6·6	16·4	21·4	18·6	25·6	1 4½
April . .	7·2	17·7	22·7	19·9	22·4	1 1½
May . .	7·4	16·0	21·5	18·4	22·6	1 2½
May-June . .	7·2	13·6	19·4	16·2	20·6	1 3½
June-July . .	6·9	11·4	17·1	14·0	24·8	1 8½
July-Aug. . .	7·4	11·0	15·3	12·9	25·1	1 11½
Aug.-Sep. . .	7·4	10·2	11·8	10·9	23·4	2 1½
Oct. 15-Sep. 15 . .	83·4	156·7	195·8	174·1	330·5	2 0½
1925-6						
Oct.-Nov. . .	6·7	9·8	12·9	11·1	41·1	3 8½
Nov.-Dec. . .	8·5	10·5	12·1	11·15	37·3	3 4½
Dec.-Jan. . .	8·7	11·9	12·2	12·0	32·25	2 8½
Jan.-Feb. . .	7·6	12·8	13·2	12·95	29·1	2 3
Feb.-Mar. . .	7·2	13·3	13·9	13·55	27·4	2 0½
March . .	8·3	18·4	19·0	18·7	24·3	1 3½
April . .	7·9	18·3	18·6	18·4	21·5	1 2
May . .	8·1	17·2	18·2	17·6	19·9	1 1½
May-June . .	8·2	14·4	16·8	15·5	17·1	1 1½
June-July . .	8·1	13·0	15·3	13·8	19·7	1 5½
July-Aug. . .	8·1	11·1	14·1	12·3	20·3	1 7½
Aug.-Sep. . .	7·3	9·3	10·2	9·7	20·1	2 1
Oct. 15-Sep. 15 . .	94·7	160·0	176·5	166·75	310·05	2 0

The quantity of food consumed shows slight variations from month to month—probably due to slight differences in the amount of meal left in the hoppers at the month-ends. In 1924-25, the average monetary return was £1 7s. 6½d. per bird, the cost of food (neglecting the kale and pasture) 9s. 7d. per bird; in 1925-26, the return was £1 5s. 10d. per bird, the cost of food 10s. per bird. The price figures show that the most remunerative period in each year was November to February, there being a marked drop in receipts in March, despite the increased number of eggs. The monthly yield and value figures have been averaged for the two years, the results being shown graphically in Fig. 1.

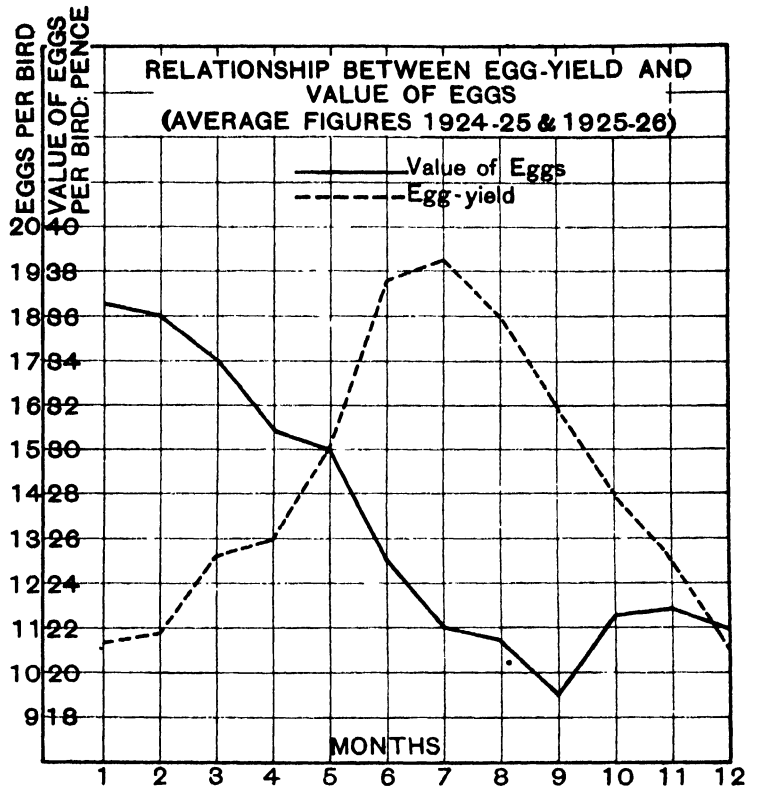

FIG. 1

Comparison of Light and Heavy Breeds.—The monthly flock averages in Table I show that the light breed flocks were considerably more profitable than the heavy flocks. Comparison of the average winter and summer totals for the two flocks yields the following figures :—

	Average yields per bird			
	Heavy breeds		Light breeds	
	1924-5	1925-6	1924-5	1925-6
Six winter months	77	76·7	86	83·3
Six summer months	83	83·3	107	93·2

The superiority of the light breeds during the summer months is in accordance with popular estimation, but the figures for the winter months are somewhat surprising. The difference between the light and heavy breeds for this period, though not very great, is probably a real one, *i.e.*, it is not due to chance.* The average monthly yields of the two flocks for the two years are expressed graphically in Fig. 2.

* Frequency curves for the two flocks suggest that the superiority of the light breeds is significant.

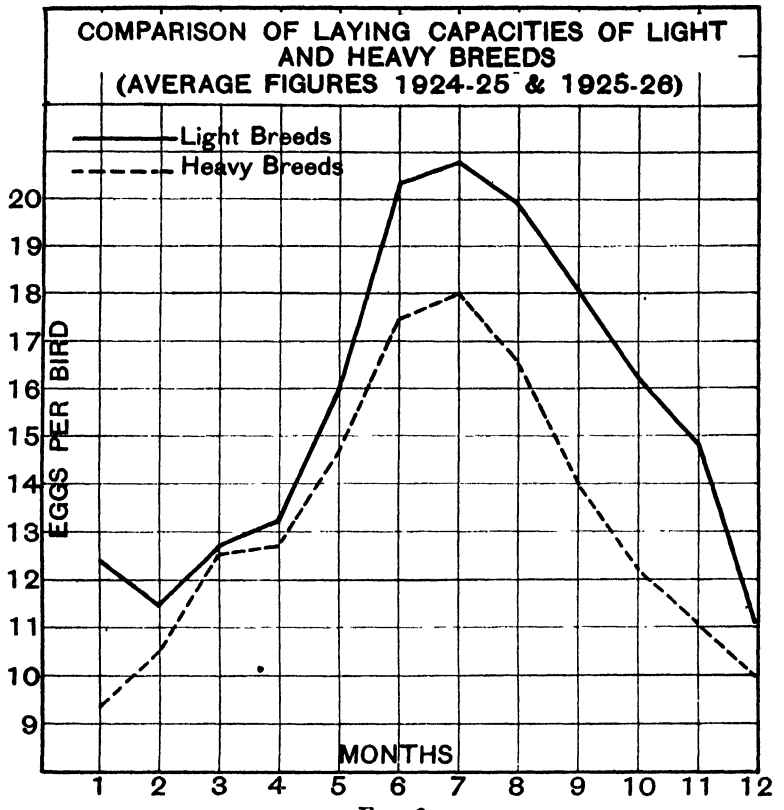

FIG. 2.

Comparison of Breeds.—Fourteen breeds were represented in the 1924-25 competition, and 12 in 1925-26, but, in most cases, the numbers of birds were too small to make comparison possible. The following table gives particulars of the performances of the two chief breeds represented.

TABLE II.—BREED AVERAGES

	Year	No. of birds	No. of flocks	Special and first grade eggs	Total eggs
White Leghorn	1924-5	36	26	144·6	198·4
	1925-6	27	20	144·5	184·0
White Wyandotte	1924-5	22	18	104	154·4
	1925-6	23	19	120·7	173·1

White Leghorns were thus much more prolific than Wyandottes in 1924-25, but, in 1925-26, the difference was scarcely significant. Rhode Island Reds were represented by a total of 23 birds, averaging 175 eggs per bird. Light Sussex birds, of which there were 16, showed remarkable variability.

Relationship between Winter Yield and Year's Yield.—The relationship existing between a bird's yield in the autumn

or winter months and her yield in the complete year is a matter of considerable practical significance. If good and bad layers could, from their records, be picked out with any degree of certainty during the early months of their laying life, breeding stock could be selected at an early date; and trapnesting could thereafter be limited to those which in the first few months put up the best records. Similarly, "wasters" could be culled at an early period and, incidentally, laying tests could be limited to a short period instead of twelve months. Clearly, however, the value of any rule or formula which might be deduced to enable one to calculate the year's yield from the three-months' or six-months' yield depends upon its reliability. Exactitude can hardly be looked for, but, on the other hand, if the error involved in making the calculation is a large one, the formula is of academic interest only.

The relationship referred to can, to some extent, be gauged from a study of the monthly records in tests such as those under discussion. It is necessary, however, to premise that the figures in these tests relate only to the period October 15—September 15, and not to a complete calendar year, still less to a complete year for every bird from the date of the first egg.

The Value of Winter-Month Records.—In the following table (III), the birds have been gathered together into groups

TABLE III

	Three-month total	Average twelve-month total		Two years' average	Six-month total	Average twelve-month total		Two years' average
		1924-5	1925-6			1924-5	1925-6	
Light Breeds	0-10	153	137	145	31-50	125	130	128
	11-20	156	160	158	51-70	178	146	162
	21-30	176	182	179	71-90	185	183	184
	31-40	191	168	180	91-110	219	198	211
	41-50	213	202	207	Over 110	219	213	216
	51-60	230	181	206				
	Over 60	212	248	230				
Heavy Breeds	0-10	109	129	119	21- 40	97	102	100
	11-20	132	136	134	41- 60	123	129	126
	21-30	125	156	141	61- 80	159	145	152
	31-40	176	148	162	81-100	167	182	175
	41-50	185	180	183	101-120	199	206	203
	51-60	180	194	187	Over 120	222	—	—
	Over 60	217	199	208				

according to the number of eggs laid in three or six months, and the twelve-month average yields for the same birds are stated alongside. Light and heavy breeds are dealt with separately, as the winter and summer yields of the two classes do not bear the same relationship to one another.

As may be seen, the correlation, between the short-period total sand the twelve-month totals, is, *on the average*, fairly close. It may, indeed, be shown by approximate statistical methods that a fair degree of correlation exists between even two or one-month totals and the corresponding twelve-month totals.

The results with individual birds have been studied by the construction of a series of regression graphs, one of which is reproduced in Fig. 3. In this graph, six-month yields for birds of the heavy breeds are measured horizontally and the corresponding yields in twelve months vertically. If the correlation between the short-period and the long-period yields were perfect, all the points would be in a straight line, the approximate position of which is indicated in the graph; but the manner in which the points are scattered indicates that the relationship is variable; any formula which could be devised for calculating twelve-month yields from those obtained in six months would therefore be subject to a considerable margin of error. The graph is a fair sample of the results for heavy breeds, when the two years are treated together, and for the light breeds in 1924-25. It does not, however, fairly represent the great degree of variability in the results with light breeds for 1925-26, in which case a few exceptional birds render the deduction of a general law extremely difficult. Thus, although the majority of the birds which laid 80 eggs in the first six months exceeded 180 in twelve months, one bird which laid 86 in the first six months did not reach 100 in the year, and another which laid 110 in six months achieved a total of only 130 in twelve. We have therefore abandoned the attempt to calculate a general formula for the deduction of twelve-month records.

It is, however, not difficult from the regression graphs to pick out the minimum three-month yields which, in five cases out of six, give twelve-month totals above any standard which may be selected. Thus, as may be seen from the above graph, 22 birds laid 100 eggs or more in six months. Nineteen of these laid 180 in the year, while three failed to reach this standard. The chances of a bird with a six-month record

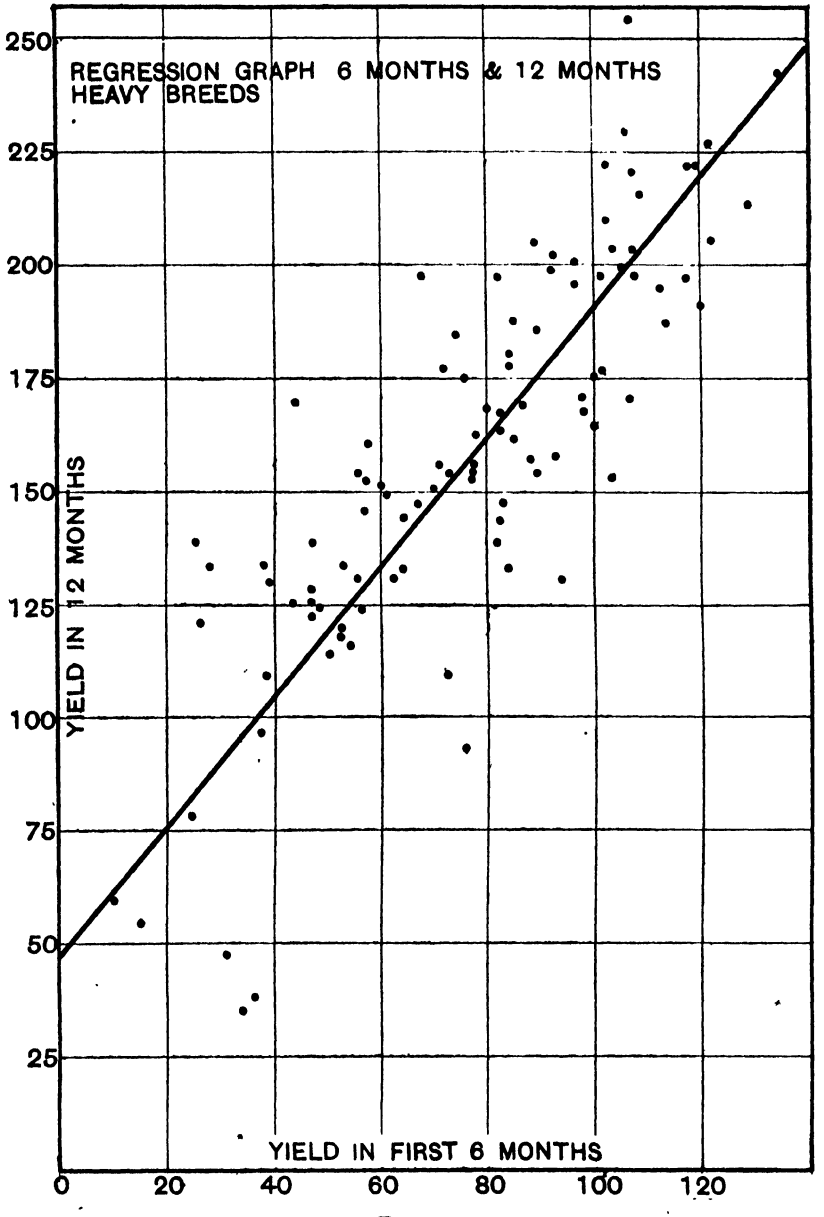

FIG. 3

of 100 or more giving 180 in the twelve months are therefore 19 to 3, or roughly 6 to 1.

At the other end of the scale, we find that the chances are 43 to 8, *i.e.*, 5 to 1, against any bird which lays less than 80 eggs in three months giving 160 in the year; and 25 to 1

against such a bird laying 180 in the year. Proceeding in this way, the standards for short periods, which in five cases out of six could safely have been used, have been worked out. These standards are put together in Table IV.

TABLE IV.

Twelve-month standard aimed at	Corresponding two-month record	Corresponding three-month record	Corresponding six-month record
LIGHT BREEDS			
(*a*) For selecting			
200 eggs and over	41	55 (?)	120
180 „ „	27	43	112
(*b*) For culling			
Below 160	?	7	60
„ 180	20 (?)	25	78
HEAVY BREEDS			
(*a*) For selecting			
200 and over	45 (?)	62	117
180 „ „	37	54	102
(*b*) For culling			
Below 160	16	32	81
„ 180	25	45	96

As might be expected from the records obtained in these tests, the winter standards for the heavy breeds, corresponding with given standards for the twelve months, are higher than those for light breeds.

Summer and Winter Yields.—In Fig. 4, the birds of heavy breeds have been grouped according to their winter and summer yields, the former yields being expressed in columns below the horizontal line and the latter above it. This figure brings into clear relief the fact that the differences between the various birds are not nearly so marked in summer as in winter. During the summer months, the best birds lay at only a slightly higher rate than the worst—the tendency is for all to attain to the same level of efficiency. Thus, in 1924-25, the average yields for the whole of the birds were :—

Winter months	77
Summer months	83

The corresponding figures, however, for the worst and best groups were :—

	Worst group	Best group
Winter average ..	30	129
Summer average ..	67	93

Thus, with the best birds, the " levelling up " process was carried so far that their summer total was actually less than their winter total. The same tendency is observable, though not to the same extent, in the light breeds.

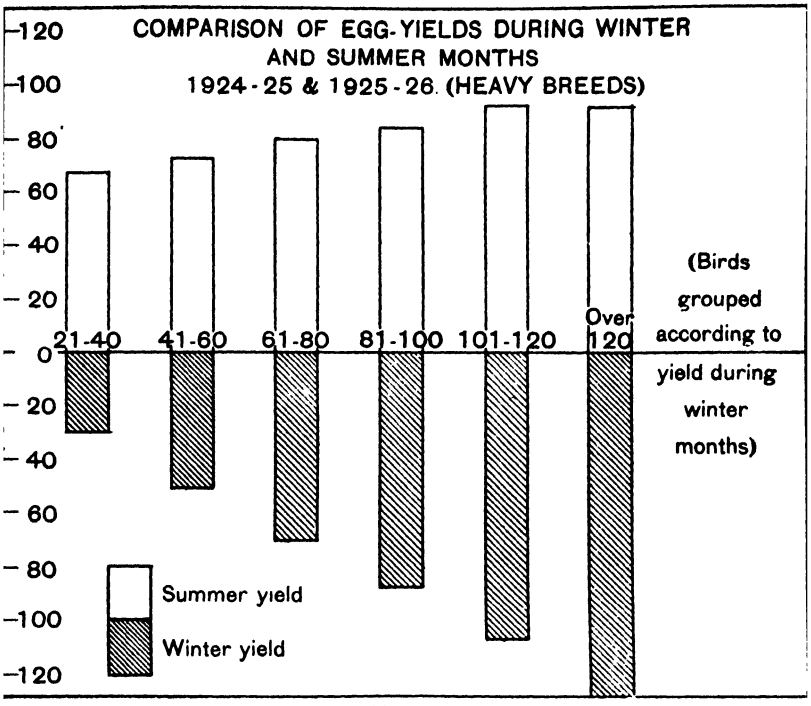

FIG. 4

Financial Yields.—If the value of the eggs laid in different periods of the year is calculated, and the results expressed in a similar manner, these facts are more strongly emphasized (Fig. 5). Owing to the higher value of the winter eggs, the winter and summer returns from the worst layers are almost equal, while, with the best, the winter returns are nearly three times those of the summer. Thus winter, tests, despite the disadvantages already noted, have, at any rate, this value —they emphasize, even more than twelve-month trials, true differences in the profitability of hens. The wisdom of attempting to cull at the end of the winter period—a practice sometimes recommended—would seem to be extremely doubtful, since losses on poor stock have already been sustained before March, and good and bad layers are more or less on a level during the summer.

Effect of Broodiness.—Records were kept of the number of times each bird went broody. There was a striking difference in this respect between the light and heavy flocks.

In the light flocks, 11 birds or 14 per cent. showed broodiness.
„ heavy „ 35 „ 70 „ „ „

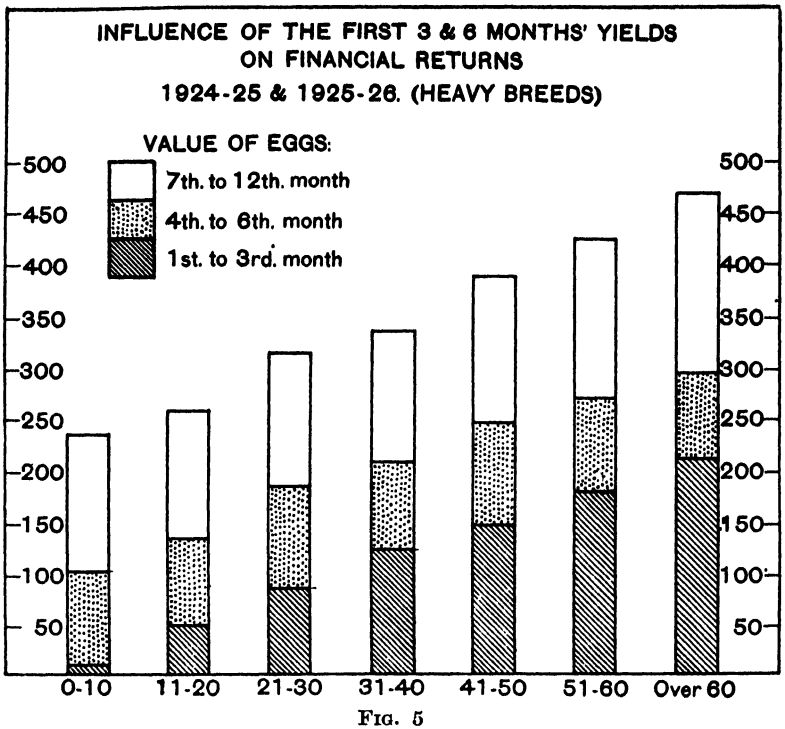

FIG. 5

No definite correlation between the number of times a bird went broody and her total egg-yield can be established—possibly because records were not made of the length of the broody periods. It was, however, noticeable that birds which laid for a short spell in the early autumn and then went broody, usually proved indifferent layers. Broodiness was most common during the summer months.

System of Grading and Scoring.—As the system of scoring in these tests is somewhat complicated, a short discussion on the points involved may not be out of place.

It has frequently been stated that home-produced eggs have, of late years, declined in size, and the system of scoring adopted in the earlier laying trials has been quoted as a contributory cause. In order to meet this objection, various systems of scoring, in which higher marks are awarded for heavier eggs, have been devised. The Ministry's system, adopted in these tests, provides not only for grading, but also for slightly different grade-standards during the first, second, and subsequent months, in order to give due advantage to those birds which lay the heaviest eggs early in the laying year; and the points allowed for each egg are varied in

accordance with the general trend of prices throughout a normal year.

The only serious criticism of this system which we have heard relates to the standard fixed for special-grade eggs. Certain breeders have argued that the weight demanded for a special-grade egg is too high, as extra large eggs are frequently poor in hatchability; and, since all birds tend to lay a slightly larger egg in their second season, there is a risk that the best scorers in the test may prove poor stock for the breeding pens. We have unfortunately no information regarding hatchability from any of the leading birds, but the scoring system does not demand more than $2\frac{1}{8}$ oz. for a special-grade egg, and the recognized weight for a good hatching egg is from 2 oz. to $2\frac{1}{4}$ oz. Furthermore, the special-grade egg of $2\frac{1}{4}$ oz. only represents, as a marketable commodity, 17 lb. per 120 eggs, whereas many consignments of Dutch and Danish eggs are graded up to 18 lb. per 120,

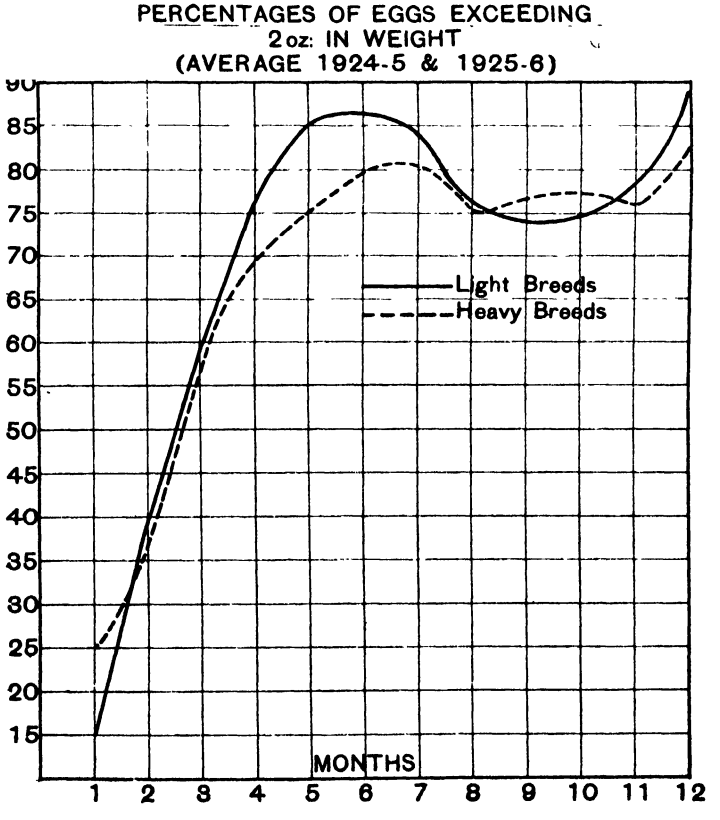

FIG. 6

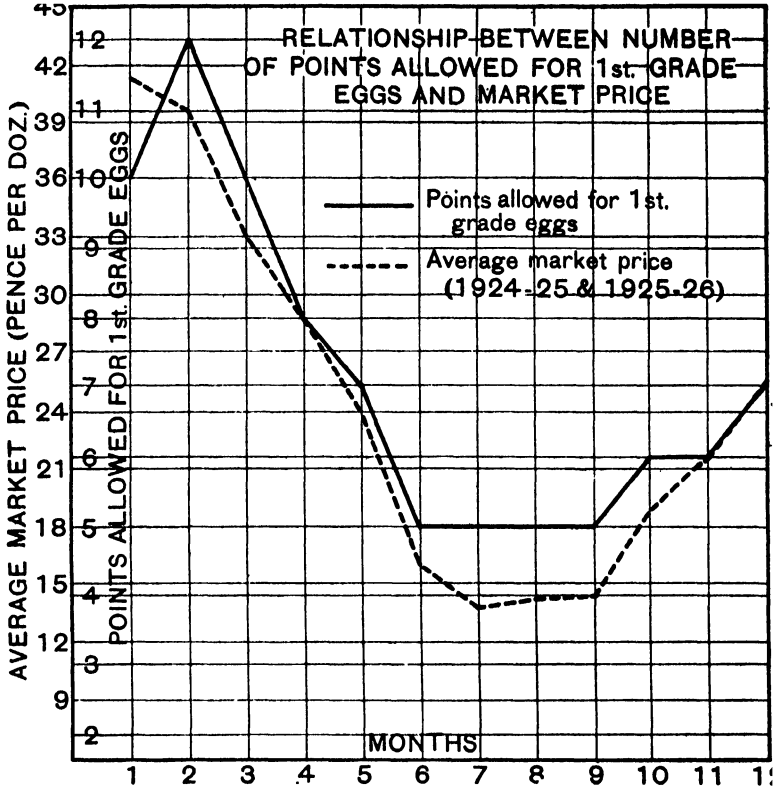

FIG. 7

while some French samples scale up to 20 lb. per 120 eggs. It appears to us, therefore, that the standards for special-grade eggs are not unduly high.

Seasonal Variation in Weights of Eggs.—A measure of the normal seasonal variation in weights of eggs can be obtained by calculating the average percentage of eggs over 2 oz. in weight laid by each pen of birds in each month. The figures so obtained have been expressed graphically in Fig. 6, the results for light and heavy breeds being given separately. It is noteworthy that the graphs for both light and heavy breeds follow very similar courses. In both cases, the proportion of 2 oz. eggs rose rapidly for the first five months, and then remained relatively steady. In both years, however, the proportion of 2 oz. eggs fell slightly during the early summer, to rise again in September.

The adoption of lower weight standards for special and first-grade eggs during the first two months is, therefore, fully justified, but it would seem, from the figures, that some

concession in the matter of weight might also be made during the third, fourth, and fifth months.

We are indebted to our colleague, Mr. L. T. Lowe, B.Sc., for much of the clerical and mathematical work involved in the preparation of this paper.

* * * * * *

SOME OBSERVATIONS ON THE SWEDE MIDGE IN NORTH WALES

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THE following preliminary account of an attack of the Swede Midge is given chiefly to draw attention to the damage done by this insect, which appears to have assumed unusual proportions and shown unusual symptoms during 1926.

The Swede Midge (*Contarinia nasturtii*) has been recognized as a swede pest for some time, and, during the years 1908-12, received especial attention from Mr. T. H. Taylor, of Leeds University, who issued a Bulletin in 1912, entitled *Cabbage Top in Swedes.* This publication was well illustrated, and is the basal source of information for subsequent workers in this country.

The insect is described as "a small, delicately formed, two-winged fly or midge, light yellowish-brown in colour, and about one-sixteenth of an inch in size. The male fly is distinguished by its long graceful antennæ, and the female by having its tail segments extended into a slender egg-laying tube or ovipositor." Mating and egg-laying are quickly accomplished, and the adult midges are short-lived, and do not feed. The eggs are very small and are laid in strings and clusters on the leaves, sometimes on the upper surface of the blade or the upper surface of the stalk, whilst the young leaves in the heart of the crown are frequently selected. Hatching takes place in a few days, the numerous legless pale yellow larvæ feeding generally where hatched, and gnawing away the plant tissues. The amount of actual damage is slight, the ill-effects resulting from the abnormal growth by the plant as a response to irritation set up by the larvæ. Taylor states "the stalks of the affected plants become swollen, and, bending sharply inwards across the top of the plant, press upon and compact the terminal bud. Moreover, the leaf-blades become delicately crumpled, thus resembling the leaves of a savoy cabbage." As a result, the growth of the plant is

checked. The feeding stage lasts about three weeks, when the larvæ attain a length of about 1-10 of an inch and possess the power of hopping (as in other members of the gall midge family). They forsake the host plant and pupate in the ground enclosed within silken cocoons. The normal number of broods appears to be three, each taking six to seven weeks to pass through all its stages, the first brood appearing during early June. In addition to swedes, other cruciferous crops may be attacked. The above notes are taken from Taylor's article.

The writer noted the presence of the swede midge in North Wales in 1920, when characteristic leaf symptoms were plentiful in some districts, but, beyond leaf crumpling, no ill-effects were apparent and the crops were not seriously affected.

In subsequent years, also, similar slight attacks were observed here and there, none of them in any way approaching the Yorkshire outbreaks described by Taylor. In 1926, however, a widespread and serious infestation occurred, the earlier stages of which were not observed owing to preoccupation with other lines of work. A stream of complaints from growers then commenced, practically none of whom knew the cause of damage, although a few stated that similar damage had occurred prior to 1920. The symptoms were : (1) leaf crumpling, (2) surface damage to leaf lamina, stalk and base, (3) distortion of young shoots, (4) death of the leading shoot, (5) double or multiple "necking" (resulting from growth of secondary shoots), (6) rotting of the crown, neck and bulb. These symptoms were all present in severely infested crops, whilst in others subjected to less serious or later attack, only stage (1), or a limited amount of the remainder, occurred. Rotting, due to bacterial infestation, followed on in plants injured by the death of the leading shoot, or through marked damage to the leaf base close up to the neck or bulb. Under drier conditions, healing appears to take place with little or no rotting, but, under damp conditions, rotting followed in serious amount, aided by the accumulation of water in the hollow (and already injured) leaf bases, and also, in many instances, in a concavity formed on the summit of the swede and within the encircling growths of the new shoots or "necks," arising subsequently to the death of the original growing point. These conditions were encouraged by a period of damp weather which followed upon the damage and was undoubtedly responsible for the commencement of much of the rotting* which was

* The rainfall at the College Farm, Aber, was: May 5·15 in., June 2·79 in., July 3·07 in., August 3·71 in.

early established and followed the sequence, (*a*) rotting terminal shoot, (*b*) a rotting invading and progressing down to the " neck," and (*c*) rotting of the crown and " root." By the first week in September, it had, in many instances, extended well into the " neck " and, in some cases, invaded the crown. After that, the progress of rotting was checked by a considerable spell of dry weather, but the damage had been very considerable, both in stunting and rotting. Taylor notes a bacterial rotting in the Yorkshire outbreaks, which he names "crown rot." There seems little doubt that the prevalence of this condition in North Wales in 1926 was largely initiated by the feeding of midge larvæ, and intensified by the subsequent unfavourable weather conditions. Cases were frequent in which the " many neck " condition was not accompanied or followed by rotting; the central area healing over, and forming a bare and generally level or convex surface in which water did not lie (contrary to the usually resultant concavity). The bulk of the serious symptoms undoubtedly followed attack by the earlier broods of midge, when the plant tissues were young; later attacks appeared to be confined to the leafage and merely resulted in the usual crumpling and slight local patches of decay.

It may be mentioned here that (in addition to the midge) swedes in North Wales suffered severely from mildew, which caused the death and shedding of a majority of the primary leaves, and this, apparently, contributed to a prolongation of the growing point and an unusual and marked lengthening of the " neck," which, the writer considers, saved many roots from " crown " rotting, since, in such cases, neck rotting had not penetrated into the bulb by lifting time, when the neck, together with the rotting region, was removed. It is undoubtedly a fact that damage other than that due to midge may bring about the " many neck " condition and subsequent rotting, and this may be due to attack by other insects; but in 1926, with the exception of some local damage by flea beetles (chiefly in South Carnarvon), this was very slight. Damage to the crown by larvæ of the cabbage root fly may occur at times, and has been seen by the writer on turnips, but no larvæ of this pest were found on roots in 1926, despite search for them. Leaf miners belonging to the genera *Scaptomyza*, *Phytomyza*, etc., may attack the leaves and leaf stalks, and a marked attack occurred on the College Farm at Aber in 1923, but no rotting followed, the crop being lifted in a particularly sound condition. In 1926, these insects,

although present here and there, were comparatively scarce. Taylor remarks that "plants growing at the edge of the field are generally attacked first," and bases his "trapcrop" method of control on this habit. This observation is upheld by the incidence of cases in North Wales, where headlands generally showed a preponderance of cases of "many neck," etc., and it has been suggested that mechanical injury may bring about the same condition. It was difficult to obtain data for swedes owing to the very general infestation, but the following figures recently obtained from a crop of turnips in Herefordshire tend strongly to confirm this view. A count was made, on January 1 last, on a root field at 550 ft. elevation in the Leominster district. Swedes grown in this field had been lightly attacked, but the turnips showed no sign of infestation. One hundred roots growing along a headland, subjected not only to injury through normal cultural operations, but in addition to those resulting from its use for carting, and for to-and-fro traffic to other fields, showed 22 cases of double or multiple necking (but little rotting). A block of 500 roots were then examined in the adjacent body of the crop, with the result that only seven examples were found, and these were scattered here and there and in no way grouped. It would, therefore, appear that, in all counts of damage by such insects, a certain allowance must be made for mechanical injuries.

As regards the distribution of attack in North Wales, the maximum damage occurred in the lowlands and coastal districts of Carnarvon, the eastern portion of Anglesey, and the Conway valley. There was a marked diminution in the westerly area of North Wales, in the regions of high precipitation, where more marked cloudy weather and cooler climate prevail, the upland districts with rainfalls of + 50 inches being largely free. In Anglesey, the attack died out gradually in a westerly direction, being (as stated) severe on the west coast, moderate to slight in the centre, and very slight or nil in the eastern districts. In Flint and Denbigh the attack was slight in many districts, but severe in certain others.

Counts were made in 86 fields, totalling about 300 acres, and ranged up to 90 per cent. of severe stunting, rotting, etc. Analyses of types of damage were attempted, as for instance on the College Farm, Aber, on November 3, 1926, on "Model" sown May 18. The total percentage of swedes seriously affected was 65.

(1) Leaf symptoms: 40 per cent. (but many had fallen through mildew).
(2) Decaying leaf bases: 16 per cent. (but many had fallen through mildew).
(3) Multiple necking (two to nine): 27 per cent.
(4) Rotting of neck and crown: 24 per cent.

In another count on "Best of All," the multiple neck rose to 44 per cent. and rotting to 30 per cent. Many cases were much worse than these.

Variety would appear to have little effect, for, though certain cases might seem to support this view, others reversed it, and, so far, no clear evidence can be given in this direction. Severe attacks were noted on "Balmoral," "Bangholm," "Best of All," "Buffalo," "Dreadnought," "Eclipse," "Lord Derby," "Magnum Bonum," "Model," "Monarch" and "Superlative."

Sowing date has also been considered in over 50 cases, these being grouped as early, mid and late; here again, no reliable conclusion appears; a 60 per cent. infestation being recorded on swedes sown as early as the end of April, and up to 42 per cent. on a crop sown as late as mid-June.

Although infestation was general in lowland districts of Carnarvon, etc., yet very variable degrees of infestation were sometimes found near one another, and, as will be seen from the above statements, these differences have not yet been satisfactorily accounted for. Differences in migration from field to field, or the presence or absence of a wild host plant, are other factors not yet investigated. An example of this variable distribution was seen near Bangor, where three adjoining fields yielded the following counts, all with practically identical soils, etc.:—

(*a*) Crop sown May 14, variety (?). Damage 5 per cent.
(*b*) ,, ,, 15, "Magnum Bonum." Damage 10 per cent.
(*c*) ,, ,, 1, "Magnum Bonum." Damage 50 per cent.

As regards other cruciferous crops, early sown rape suffered very severely (in some cases 90 per cent. of shoots rotted, and the crops were markedly stunted), while late-sown crops escaped. Turnips were unaffected even when growing alongside heavily damaged swedes, slight leaf crumpling in one or two cases being all that could be found. Savoys were damaged in several places, many being "blind." It is hoped to obtain further information during 1927.

* * * * * *

BROWN ROT OF APPLES: THE NEED FOR CAREFUL PICKING AND SORTING

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Horticultural Research Station, East Malling, Kent.

IN recent years, the brown rot disease of fruit, caused by *Sclerotinia fructigena*, has been very prevalent. The disease was particularly severe in 1926, and it was not only common on apples and pears, the usual hosts of this fungus, but considerable loss in the plum crop resulted from infection by the same parasite.*

So far as is known, primary infection of the fruit by *Sclerotinia fructigena* takes place only through wounds, such as those caused by biting insects, but, when one apple of a cluster becomes infected, the disease can extend from that apple to those touching it, across the points of contact. The fruit may be infected when young and growing, and also at maturity, while infection may also take place at the time of picking or during the subsequent handling. The disease is the most common cause of loss in apples during the early stages of storage, and the so-called "black rot" of stored apples is caused by the same fungus. As mechanical injury renders the fruit so liable to infection, it is obvious that, especially in years of epidemic infestations, care must be taken not to cause unnecessary injury when the fruit is picked and afterwards when it is graded and packed or stored.

One form of injury may occur at the time of picking, by removing the fruit from its stalk instead of picking it with the stalk attached. That injury of this kind may soon lead to loss in the crop is shown by observations made at East Malling in the autumn of 1926.

Early in September, as the apples were being picked and graded for packing and marketing, it was noticed that fruit, apparently quite sound when received from the pickers, showed very pronounced brown rot within two or three days. On investigation it was found that in nearly every instance the rot had started at the stalk end, and this condition only appeared on those apples which had been pulled away from the stalk when picked. Observations were made on a batch of apples which had been picked three days previously, and already a number of those without stalks showed the typical

* A closely related fungus, *Sclerotinia cinerea*, also causes brown rot of plums and cherries; in addition to causing fruit rot, it infects the flowers and so produces blossom-wilt.

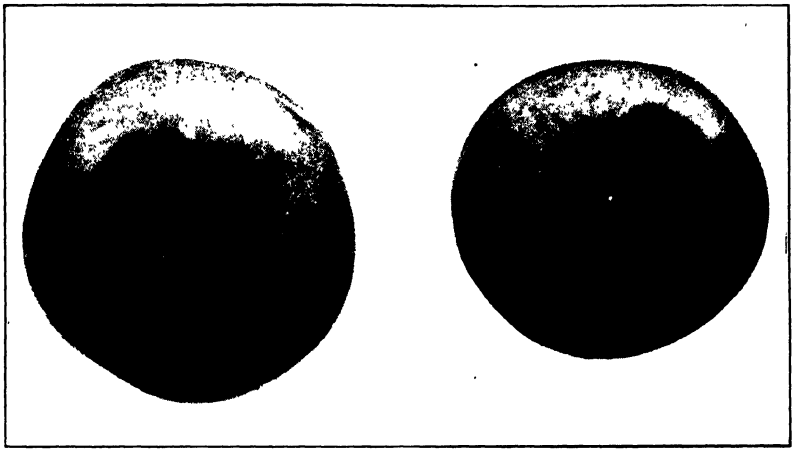

FIG. 1.—Apples three days after picking: infection has set in where the apples were pulled from the stalks.

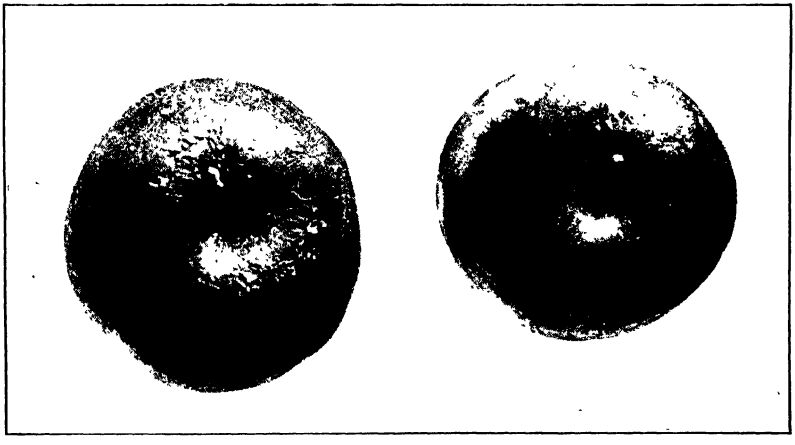

FIG. 2.—The same apples two days later. The rot has extended and the apple on the left bears fructifications of *Sclerotinia fructigena*.

[*Photographs: copyright of the Horticultural Research Station, East Malling.*]

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brown rot, the discoloration in some cases extending for half an inch or more from the stalk end wound.

The variety in which this type of injury was observed was "James Grieve," which is not only very susceptible to brown rot infection of the fruit, but, being a soft-wooded variety, the rot often extends from the fruit into the spurs and also into the branches to form cankers.

To obtain some idea of the rate at which rot progresses in fruit infected in this way, apples showing rot starting at the stalk end were selected; two of them were photographed at this stage and are shown in Fig. 1. The margin of the brown area in each case was then marked with ink. The apples were placed on a bench in an unheated laboratory, the temperature of which was approximately that of the packing shed.

On the following day, it was found that the rot had extended 7 to 16 mm. (on the average about $\frac{1}{2}$ in.) beyond the marked line within the 24 hours. During the next 24 hours, the rot proceeded at about the same rate, so that nearly half the surface of each apple was brown, and a few yellowish spore-bearing tufts, the fructifications typical of the fungus, were appearing at this stage (*see* Fig. 2). A few days later, the apples were completely brown, and numerous fructifications were present. It is obvious that the apples had become infected soon after they were picked, and that the fungus had entered through the wound caused by removing the fruit from the stalk.

It is apparent, also, that, had these apples been sent to market, when they already showed evidence of infection, they would have been unsaleable soon after their arrival. However carefully apples are picked, a certain number will be pulled away with damaged "strigs." During grading, these should be set aside with the bruised fruit for immediate use. Such fruit should not be stored. Slight injuries in themselves are not necessarily very harmful, but, since they serve as ports of entry for certain parasites, such as the one under consideration, care in picking, grading and packing is essential for successful storing and marketing of fruit. Since it is impossible to eliminate mechanical injuries altogether, especially when large quantities of fruit have to be handled, the grower should endeavour to reduce the chances of infection to a minimum by removing as far as possible all sources of infection. In certain seasons, it is not uncommon, at the time of picking, to see the ground under apple and pear trees strewn with fruit infected with brown rot and bearing myriads of spores which

blow about and cause further infection. The collecting of such fruit and rendering them innocuous by burning or burying is possible in a garden or small plantation, but is hardly a practical proposition on large fruit farms.

The grower, however, should realize that rotting fruits, whether on the tree or on the ground, are a source of danger, and when it is at all practicable they should be destroyed. He is reminded, too, that apples infected with brown rot frequently remain on the tree through the winter. These "mummies," if left on the trees, produce, in the following spring, another crop of spores which serve to start infection in the young fruit. It is therefore sound practice to remove, during the winter, any withered apples that may be found on the trees.

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THE INTERNATIONAL ECONOMIC CONFERENCE, 1927: DOCUMENTS RELATING TO AGRICULTURE

A number of documents relating to agriculture were prepared for the use of the International Economic Conference, held at Geneva last May.* The more important of these are as follows :—*Agricultural Problems in their International Aspect* (C.E.I. 36), prepared by the International Institute of Agriculture, Rome. This is mainly a statistical summary of the data in the possession of the International Institute. It includes a general introduction, followed by statistical tables relating to :—

(1) Production, trade, consumption, prices.

(2) Materials relating to certain aspects of agricultural economics, including the distribution of landed property in agricultural holdings, agricultural population and certain data relating to index numbers of agricultural prices and costs. These are set out for a number of different countries.

(3) The marketing of agricultural produce—consisting mainly of a comparison of index numbers of wholesale and retail prices relating to agricultural produce.

Two short sections are also included relating to the development of agricultural co-operation and to international agricultural credit respectively.

* These are obtainable from Messrs. Constable & Company, 10 Orange Street, London, W.C.2.

Agriculture and the International Economic Crisis (C.E.I. 43), prepared by three members of the Sub-Committee on Agricultural Questions of the Preparatory Committee for the International Economic Conference—M. Jules Gautier, Dr. Andreas Hermes and Mr. H. A. F. Lindsay. The document attempts to compare statistically the change which has taken place, as compared with pre-war conditions, in the relation of agricultural prices to working expenses. It also makes a rough comparison of the value of agriculture and industry in the world's economics. In its general conclusions, it calls attention to the dependence of agriculture upon the prosperity of the industrial community.

The Part played by Co-operative Organizations in the International Trade in Wheat, Dairy Produce and some other Agricultural Products (C.E.I. 14), prepared by the International Labour Office. This valuable document relates not so much to the ordinary aspects of agricultural co-operation, as to the growing importance of co-operative organizations in international trade, and to the relations of producers' and consumers' organizations. In the first section, a brief summary is given of the chief co-operative marketing associations engaged in international trade, including those of Canada, Denmark, the U.S.A., Australia and Russia. The second section deals with distributive co-operative societies and the part played by them in international trade. The third section deals with the relations of distributive co-operative organizations and agricultural co-operative marketing societies. Examples are quoted of the various methods which have been adopted to facilitate direct trading between producers' and consumers' organizations. An appendix follows dealing with a number of individual commodities.

The Relation of Labour Costs to Total Costs of Production in Agriculture (C.E.I. 27), prepared by the International Labour Office. The subject of this memorandum is an exceedingly difficult one; it attempts to ascertain the proportion between labour costs and total costs in agriculture for a number of countries. Necessarily, it has depended on the data of costs collected by methods which are dissimilar, and a great many considerations prevent the results being strictly comparable, as between one country and another, or between one system of farming and another; moreover, in several countries, the figures are based on data collected from very few farms. Thirteen countries are included in the

investigation. As might be expected, the results differ very widely.

Results of certain Inquiries for instituting a Comparison between Retail Prices in Private Trade and those of Distributive Co-operative Societies (C.E.I. 11), prepared by the International Labour Office. Inquiries undertaken both by co-operative societies and by public authorities are included and relate to a comparatively small number of countries. The results indicate that, on an average, the retail prices charged by co-operative societies are lower than those charged by private trade, in addition to which consumers, who are members of co-operative societies, in many cases have the further advantage of receiving a dividend on their purchases.

Apart from the above, there were issued for the use of the International Economic Conference a number of documents bearing on the general economic situation, which were of considerable interest to agriculturists. Of these may be mentioned, *Principal Features and Problems of the World Economic Position from the point of view of Different Countries* (C.E.I. 29). This was issued as a result of an invitation addressed to the representatives of the various countries taking part in the Conference to prepare statements of their respective national economic conditions. Only a small proportion of the total number of countries responded to this invitation, but the statements contain some important information as to the effect of post-war economic policy in the various States and its reaction upon agriculture, particularly in some of the Central European countries.

Memorandum on Production and Trade (C.E.I. 3). This memorandum was prepared by the Secretariat of the League of Nations with the collaboration of a Committee of Economists, and analyses the available statistical data in order to show the changes since 1913 in (1) Population and its territorial distribution, (2) production of raw materials and foodstuffs, (3) the total of world's trade. The results indicate that, in 1925, the population and trade of the world were both about 5 per cent. greater than in 1913. The production of foodstuffs (exclusive of China) and raw materials has increased by about 16 to 18 per cent. In the case of Europe, however, with an increase in population of a little over 1 per cent., the production of raw materials and foodstuffs (the latter owing largely to a favourable harvest) was, in 1925, 4 to 5 per cent. above pre-war. European trade was, however, probably 10 per cent. below that level. Within Europe, eastern and central countries are

below the western, but have made considerable progress in the last two years. The big increases which have taken place are in the rest of the world, conspicuously in North America, where there is an increase of about 20 per cent. in population, 25 per cent. in the production of foodstuffs and raw materials, and over 33 per cent. in trade.

Summary Memorandum on Various Industries (C.E.I. 19) prepared by the Economic and Financial Section of the League. The subjects of productive capacity, production, international trade, prices and tariffs are dealt with, and this is followed by a short analysis of the causes of the economic depression. It also includes an outline of various proposals put forward for international action. This document was one of the most important summaries of the general position which the Conference had before it.

Other important publications are: *Population and Natural Resources* (C.E.I. 39), giving a list of the main sources of raw materials, together with the production in each country in 1925, and a table showing the density of population in relation to cultivated areas; *Migration in its various Forms* (C.E.I. 25); *Standard of Living of Workers in various Countries* (C.E.I. 26); and *Marks of Origin* (C.E.I. 20).

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SEPTEMBER ON THE FARM

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Seasonal Notes.—The summer of 1927 will long be remembered both for its dry and for its wet periods, but particularly for the wetness which impeded or prevented haymaking operations for such a long time. At the end of July, many farmers had secured no good hay at all, and now—nearing the middle of August—unmown meadows adjoin wheat that is yellowing or winter oats that are dead ripe. In some cases, the uncut or spoiled hay crop adjoins a particularly luxuriant field of mangolds or cabbages, emphasizing the lesson that in such a climate as ours the green crop has a special value as an insurance against the effects of a bad hay harvest.

The hope that July might be free from tempests was not realized, and, consequently, there are now many cornfields where harvesting operations will be retarded by the inability of the self-binder—even when fitted with ear lifters—to cut

on all sides. Corn cutting, therefore, will probably extend well into September. Formerly, when the acreage of corn grown in this country was greater and all the reaping and binding had to be done by hand, the *harvest moon* was a matter of special interest. This year the time of harvest moon is roughly from September 9, when the nearly full moon rises at 6.18 p.m., to the 15th, when the time of rising is still no later than 8.23 p.m.

Weeds in Straw.—The abundance of daisy-like weeds in corn crops this year has brought in queries as to whether the straw from infested crops is likely to be injurious to live stock consuming it. One correspondent asks whether the infested straw might safely be fed as chaff. As a rule, fodder containing plants of doubtful character should not be chaffed, as this prevents the cattle from rejecting—as they often will—herbs of unpleasant odour and injurious properties.

As regards mayweeds or chamomiles, there are several plants which are not easily distinguishable by the layman, but the most objectionable species—stinking mayweed—has an unmistakable odour. Long, in his *Plants Poisonous to Live Stock*, states that, considering the prevalence of mayweeds, there would be more evidence of the damage they would cause if they were poisonous. He quotes investigations, however, which throw suspicion on the seeds of stinking mayweed and corn chamomile and includes them among the plants liable to impart taints to milk.

The tainting of milk and its products by mayweed, infesting seeds hay, was specially investigated at Reading in 1924-26, where it was found that a daily allowance of 10-13 lb. of hay containing 17 per cent. of mayweeds of several species imparted a strong taint to milk within 12-36 hours after commencing to feed the hay. Further studies of the potency of the various kinds of mayweed showed that the chief offender was the species known as stinking mayweed, while the other kinds had either definitely no effect or gave a doubtful result.

Charlock seeds are well known to be dangerous to cattle, but, fortunately, the seeds are usually thrashed out when the corn passes through the thrashing mill. As regards younger plants of charlock, such as sometimes occur in crops cut for silage before the seeds have formed, there appears to be little danger from this source. Last winter the writer had under observation a herd of Shorthorn cows to which was fed a daily

ration of 25 lb. of silage containing a large proportion of flowering charlock, and no ill effects were noticed.

Wheat Seed.—There is little land ready for drilling with wheat in September, the only fields available being such as have been bare-fallowed or half-fallowed after early-cut silage crops. It is in this month, however, that the farmer decides whether to thrash and sow his own seed or to obtain new; he has also to consider the question of varieties. If the decision is to adhere to the same varieties as have been grown during the past season, change of seed may or may not be advisable according to circumstances. The case of seed corn is not comparable with that of potatoes, where, in certain districts, the crop becomes so full of virus diseases as to be unfit for planting again after two or three seasons' growth. The main considerations in the case of seed corn are the ripening and harvesting of the sample. Given two equally well-fed, well-ripened, and well-harvested samples of wheat, the one home-grown and the other brought from a distance, the chances are in favour of the first producing the heavier crop.

New seed should be obtained when the home-grown sample is defective, as it may be if the crop has grown unevenly, ripened badly or suffered from bad weather at harvest time. The presence of more than traces of bunt in the crop and the occurrence of blow-away smut, as mentioned in last month's notes, should condemn the sample for seed purposes, as should also undue adulteration with seed not belonging to the variety desired. After a wet, late harvest, the need for new seed becomes all the greater, especially in northern and western districts. It is common knowledge that seed which is rather soft and immature germinates both slowly and unevenly, but improves in these respects on further drying and keeping. Such delay in the case of wheat is impossible owing to the short interval between harvest and seed time; it is sound economy in this case to purchase new seed from an earlier district where harvesting conditions have been more favourable. I have seen several cases where complete failure has followed the sowing of local seed after a late harvest, or when the variety has been a late-ripening sort, while adjoining plots of southern-grown seed drilled on the same day have come up quickly and evenly, stood the winter well and made full crops.

Varieties of Wheat.—As a general policy, it is doubtless safest to rely mainly on sorts that have gained a good

reputation in the district and given satisfactory yields on the farm in question; but, on every farm where wheat is an important crop, there should be one or more trial plots in which a different variety is compared with that grown as the main crop. Even where the trial is not carried to the point of comparing yields per acre after thrashing, valuable information can be gained by observation of such matters as strength of straw, date of ripening, and, in the earlier stages, resistance to winter conditions. This year, different varieties have shown appreciable differences in their capacity to suppress weeds, which capacity may be of special interest in certain rotations.

It is not intended here to enter into the comparative merits of the many different sorts of wheat, or to review the trials carried out in various counties. Particulars of local results are obtainable on application to the Agricultural Organizer for the county in which the experiments have been carried out. Special attention may, however, be called to the following results of trials conducted in 1924-25 by, or on behalf of, the National Institute of Agricultural Botany. The trials were carried out at four centres, and at each centre there were ten pairs of comparisons between variety under test and control (Squarehead's Master). The yields are here (approximately) stated with reference to Squarehead's Master as 100 :—

	Cambridge (heavy clay)	*Hants* (heavy clay)	*Norfolk* (loam)	*Salop* (sandy loam)	*Average*
Wilhelmina ..	112	97	109	109	106·7
Iron III ..	114	81	98	113	101·3
Cambridge Browick ..	97	90	108	111	101·3
Little Joss ..	103	96	113	93	101·2
The Fox ..	103	99	108	94	100·8
Yeoman II ..	100	92	108	91	97·7

The order of ripening was as follows : Squarehead's Master, Little Joss, Yeoman II, Wilhelmina, Browick, Fox, and Iron III. The order of length of straw was almost exactly the same, the only difference being that Yeoman came between Browick and Fox.

Beet and Potatoes.—This year, potato crops, where grown from good seed and suitably manured, are particularly luxuriant, so that, if disease does not damage the tops and blight the tubers, good yields are likely to be harvested. There is, however, one field where the luxuriance of the potato crop is a matter of special interest, not only to the

grower, but also to a large party of farmers who saw the same field last year. A year ago, the field was an almost complete failure of beet and mangolds, patched with moderate success with common turnips; and a keen discussion arose among the party visiting the farm (which had gained a high place in the County Farm Competition) as to the cause of the failure of the intended crops. The cultivations had been skilfully carried out, the manuring had been both liberal and timely in application, and there was evidence that the seed had germinated with sufficient regularity to make a full plant; but there were large patches where the seedlings had not grown beyond the three- or four-leaf stage by the end of August, some places where they had died out, and smaller areas where the crop had made excellent progress. The most confident opinions were that the root of the trouble was bad drainage.

The writer recognized the symptoms as those of soil sourness, and subsequent tests revealed a high lime requirement. The farmer first decided to lime the field during the ensuing winter and follow with spring oats and small seeds, but, partly because of the difficulty of obtaining lime and its high price for some time after the settlement of the coal dispute, he accepted the advice to try potatoes without the application of lime. The land having been well manured for the crop that failed and the yard manure being more needed on other parts of the farm, the only dressing applied to the potato crop was 2 cwt. of sulphate of ammonia, 3 cwt. of superphosphate, and 2 cwt. of sulphate of potash per acre. The variety planted was King Edward, Scotch seed. The resulting crop is the best that the field in question has been known to bear for many years, although it must be mentioned that potatoes had not been tried there since the field began to give unsatisfactory results. This is not the first instance within the writer's experience where the great differences between potatoes and beet in their reaction towards soil acidity have been observed as sufficient to cause failure of the beet crop, while not sufficient to interfere visibly with the success of potatoes. It will, of course, be necessary to lime this field before success may be expected with wheat, barley, clover, or other crops that are less tolerant of soil sourness than are rye, potatoes, and turnips.

Live Stock.—Given weather conditions which permit of field operations, September should be one of the busiest months of the year. Indeed, the wisdom of active progress at this season is expressed by the saying that "Fools grow fat in

September." In the live-stock departments, also, careful management and strict oversight are now needed to avoid the many ills which are associated with the end of the grazing season and the incidence of colder nights and heavy dews. Calves should be housed at night, cows require increased rations of dry food to avoid loss of condition and fall in milk yield, and sheep are not yet free from the dangers of fly attack, while additional attention is required to control foot

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending August 10				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½%) ..	..	..	..	12 15	16 5
Sulphate of ammonia :—					
Neutral (N. 20·6%)	9 18*	9 18*	9 18*	9 18*	9 7
Calcium cyanamide (N. 19%) ..	8 6‡	8 6‡	8 6‡	8 6‡	8 9
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 16	4 0
Potash salts (Pot. 30%)	4 17	..	..	4 12	3 1
,, (Pot. 20%)	3 12	3 2	3 9	3 4	3 2
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 5	3 5
Sulphate ,, ,, (Pot. 48-51½%)	11 10	10 5	10 16	11 2	4 4
Basic Slag (T.P. 32%)	3 4§	..	2 19§	..	..
,, (T.P. 30%)	3 2§	2 18§	2 17§	2 15e	1 10
,, (T.P. 28%)	..	2 10§	2 10§	.	..
,, (T.P. 26%)	..	2 5§	2 5§	..	..
,, (T.P. 24%)	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10d	0 10
Fine grade‖	2 10	..	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	..	..	3 4	3 0	1 9
,, (S.P. 33%) ..	..	..	3 2	..	..
,, (S.P. 30%) ..	..	2 15	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	6 0†	6 2†	6 5	5 17	.

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station.

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of towns mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Prices for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.O.R. Northern rails; 3s. 6d. per ton extra on Southern rails.

rot. Where the seeds layers are being broken up for wheat the sheep now begin to be folded on roots and, to avoid scour as a result of the change to more watery and less mature diet, the change should be made gradually and a little extra dry food should be provided. The ewe flock, where not already mated up for early lambs, should now be prepared for mating by being " flushed," which means more liberal feeding for the purpose of ensuring a heavier crop of lambs.

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NOTES ON FEEDING STUFFS FOR SEPTEMBER

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The Composition and Feeding Value of Sugar Beet Tops.—With the approach of autumn, the manifold problems connected with the lifting and disposal of the sugar beet crop begin to engage the attention of the farmer. Soon, in the fields, the labourer will be busy topping the beets, and large quantities of tops will be left strewing the ground after the roots have been dispatched to the sugar factory. At first glimpse, these crop residues strike one as distinctly unattractive, and it may be that the farmer will be inclined to plough them into the land in order to save both time and trouble. He will thereby make a mistake, however, for these wilting, soil-stained tops are endowed in reality with quite surprising nutritive qualities, and constitute, when properly understood, a very useful food for farm stock.

That this is the view held by the German farmer, whose experience of this crop is riper than that of the farmer in this country, is manifest from the following quotation from Kellner's well-known text-book on animal nutrition : " Liberal feeding with the *leaves* of the sugar beet, which often takes place during and after harvesting of the beets, has the same effect as with good pasture or clover feeding, and gives a milk richer in dry matter and fat because of the quantity of protein in the fodder." Indeed, sugar beet tops are so prized as a feed for farm animals in Germany, that the sugar factories go to a great deal of trouble and expense in drying down artificially large masses of the wet tops for preservation for winter use.

During the past year, there has been carried out at Cambridge an investigation into the question of the composition and nutritive value of sugar beet tops. Digestion experiments were conducted on sheep in which the daily ration was composed

of 4,000 grammes of sugar beet tops and 600 grammes of chaffed meadow hay of known digestibility, together with a few grammes of precipitated chalk. The tops, before being given to the animals, were allowed to wilt on the stone floor of a cool room for periods varying from three to six days. In connexion with this question of wilting, the object of which will be dealt with in the Notes for next month, it may be mentioned that, under such conditions, it was possible to leave the tops for over a month without decay setting in, excepting traces on the cut surfaces of the roots. Indeed, after fourteen days' wilting, it was noted that the material had acquired a pleasant odour not unlike that of good hay.

The sheep consumed the mixed ration of sugar beet tops and meadow hay with evident relish, displaying marked fondness for the tops. Such small food residues as were left in the experiment consisted entirely of hay. That stock are appreciative of sugar beet tops is not, however, demonstrated merely by the observations in this single trial. It is also borne out by experience on a much larger scale on the University Farm, where animals are annually permitted access to these sugar beet residues; and it is further confirmed by the unanimous opinion of all those farmers with whom the writer has had the opportunity of discussing the matter. This is an encouraging fact to keep in mind, then, that no difficulty of any kind need be expected in inducing farm animals to consume the crop of sugar beet tops.

The main features of sugar beet tops in respect of chemical composition are summarized below.

Moisture Content.—Sugar beet tops must be classified with the succulent foods. The percentage of water usually amounts to 83 to 85 per cent. The wettest tops are those grown on fen soils, and, in this case the moisture content may be as high as 88 per cent. In other words, such fen-grown tops may contain as much water as milk or mangolds.

Carbohydrate Content.—The most important food ingredient in the sugar beet tops is the sugar of the crowns. The percentage of this constituent is naturally dependent on the ratio of crown to leaf. The results of numerous German analyses indicate that the percentage of sugar may vary from 14 to 23 per cent. of the dry matter of the tops. In the Cambridge investigation, the ratio of crown to leaf was fairly high, the leaves being somewhat stunted in growth, whereas the roots were of medium size. It was found that sugar constituted as much as 4·4 per cent. of the *moist* tops. Since the percentage

of dry matter in the tops after wilting was 21·7 per cent., it follows that roughly one-fifth of the total dry substance in the sample consisted of sugar. Obviously, a material which contains such a significant amount of this valuable constituent is not to be despised as a feeding stuff. The total amount of carbohydrate of all kinds accounted for approximately one-half of the dry substance of the tops.

Protein Content.—The dry matter of sugar beet *leaves* contains about 26 per cent. of protein and only about 10 per cent. of fibre. The leaves may, therefore, be looked on as possessing the characteristics of an immature green fodder like young pasture grass. The percentage of protein in the tops will be governed by the value of the ratio of crown to leaf, and will be high when the percentage of carbohydrate is low, and low when carbohydrate is present in large amount. In numerous analyses, carried out in the Cambridge laboratory, of beet tops from many different types of soils, values were obtained for the protein content ranging from 9 to 19 per cent. of the dry matter.

Oil Content.—As with roots and green fodders in general, the amount of oil in beet tops is very low. Oil from such a source has no great value in the nutrition of animals.

Fibre Content.—The amount of fibre in sugar beet tops is relatively low, usually less than 10 per cent. of the dry matter.

Ash Content.—Beet tops are very rich in inorganic constituents, and the amount may be augmented very considerably if care is not exercised in the field to prevent unnecessary contamination with soil.

The various facts cited above are brought together in the following table, which records the composition of the sugar beet tops used in the digestion trial:—

COMPOSITION OF SUGAR BEET TOPS

	Dry matter basis Per cent.	Wet tops (83·8% moisture) Per cent.
Protein	12·55	2·03
Oil	2·76	0·45
Carbohydrate	53·61	8·68
Fibre	9·92	1·61
Ash	21·16	3·43

Digestibility.—The results of the digestion trial demonstrated that sugar beet tops constitute a highly digestible food. No less than 79 per cent. of the organic matter in the tops was digested and utilized by the sheep. The carbohydrate constituent, which included the sugar in the crowns, was especially well digested, the digestion coefficient attaining to

the very satisfactory value of 83 per cent. Even the fibre in the tops was well utilized, the sheep being able to digest more than 70 per cent. of this constituent.

It was further shown that 100 lb. of the dry substance in sugar beet tops contained 61·8 lb. of digestible organic matter, equivalent to about 53 lb. of starch, and including 8·9 lb. of digestible protein, 1·7 lb. of digestible oil, 44·2 lb. of digestible carbohydrate and 7 lb. of digestible fibre. A more concrete idea of the nutritive value of beet tops may be gained, however, from the data given in the table below, where it is shown that 40 lb. of mangolds (containing 89·3 per cent. of

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	11 6
Maize	81	6·8	8 9
Decorticated ground nut cake	73	41·0	11 5
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·66 shillings, and per unit protein equivalent, 0·82 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 19
Oats	60	7·6	8 6
Barley	71	6·2	9 14
Potatoes	18	0·6	2 8
Swedes	7	0·7	0 19
Mangolds	7	0·4	0 19
Beans	66	20·0	9 12
Good meadow hay	31	4·6	4 6
Good oat straw	17	0·9	2 6
Good clover hay	32	7·0	4 11
Vetch and oat silage	13	1·6	1 16
Barley straw	19	0·7	2 11
Wheat straw	11	0·1	1 9
Bean straw	19	1·7	2 12

DESCRIPTION	Price per qr. s. d.	lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	12 15	0 13	12 2	72	3 4	1·78	9·6
Barley, Canadian No. 3 Western	42 0	400	11 15	0 10	11 5	71	3 2	1·70	6·2
„ Algerian	40 9	„	11 8†	0 10	10 18	71	3 1	1·65	6·2
„ Persian	38 6	„	10 15	0 10	10 5	71	2 11	1·56	6·2
Oats, English, white	—	—	10 13	0 11	10 2	60	3 4	1·78	7·6
„ „ black and grey	—	—	10 0	0 11	9 9	60	3 2	1·70	7·6
„ Scotch white	—	—	11 10	0 11	10 19	60	3 8	1·96	7·6
„ Irish white	—	—	11 5‖	0 11	10 14	60	3 7	1·92	7·6
„ Canadian No. 2 Western	32 3	320	11 5‖	0 11	10 14	60	3 7	1·92	7·6
„ „ feed	28 0	„	9 17*	0 11	9 6	60	3 1	1·65	7·6
„ American	24 3	„	8 10†	0 11	7 19	60	2 8	1·43	7·6
„ Argentine	27 0	„	9 8	0 11	8 17	60	2 11	1·56	7·6
„ Chilian tawny	27 6	„	9 12	0 11	9 1	60	3 0	1·61	7·6
„ New Zealand	33 3	„	11 13*	0 11	11 2	60	3 8	1·96	7·6
Maize, American	40 3	480	9 8‖	0 10	8 18	81	2 2	1·16	6·8
„ Argentine	35 0	„	8 3	0 10	7 13	81	1 11	1·03	6·8
„ South African	33 6	„	7 17*	0 10	7 7	81	1 10	0·98	6·8
Peas, Indian white	—	—	12 0*	1 2	10 18	69	3 2	1·70	18
„ Japanese	—	—	21 0‖	1 2	19 18	69	5 9	3·08	18
Dari, Egyptian	—	—	10 10	0 12	9 18	74	2 8	1·43	7·2
Millers' offals—									
Bran, British	—	—	7 7	1 3	6 4	42	2 11	1·56	10
„ broad	—	—	8 7	1 3	7 4	42	3 5	1·83	10
Middlings, fine, imported	—	—	9 17	0 18	8 19	69	2 7	1·38	12
„ coarse, British	—	—	9 10	0 18	8 12	58	3 0	1·61	11
Pollards, imported	—	—	7 15	1 3	6 12	60	2 2	1·16	11
Meal, barley	—	—	11 17	0 10	11 7	71	3 2	1·70	6·2
„ maize	—	—	9 5	0 10	8 15	81	2 2	1·16	6·8
„ „ germ	—	—	8 15	0 16	7 19	85	1 10	0·98	10
„ „ gluten feed	—	—	8 15	1 1	7 14	76	2 0	1·07	19
„ locust bean	—	—	8 10	0 8	8 2	71	2 3	1·20	3·6
„ bean	—	—	12 0	1 6	10 14	66	3 3	1·74	20
„ fish	—	—	20 10	3 10	17 0	53	6 5	3·44	48
Maize, cooked flaked	—	—	10 15	0 10	10 5	85	2 4	1·25	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 0	1 10	10 10	74	2 10	1·52	25
„ „ „ 10% „	—	—	11 12	1 10	10 2	74	2 9	1·47	25
„ „ „ 9% „	—	—	11 5	1 10	9 15	74	2 8	1·43	25
Soya bean „ „ 6% „	—	—	11 10	2 3	9 7	69	2 9	1·47	36
Cottonseed cake „ 5½% „	—	—	6 12	1 8	5 4	42	2 6	1·34	17
„ „ Egyptian, 5½% „	—	—	6 10	1 8	5 2	42	2 5	1·29	17
Decorticated cottonseed meal, 7% oil	—	—	11 2†	2 3	8 19	74	2 5	1·29	35
Coconut cake, 6% oil	—	—	9 10	1 5	8 5	79	2 1	1·12	16
Ground-nut cake, 7% oil	—	—	9 12†	1 8	8 4	57	2 11	1·56	27
Decorticated ground-nut cake, 7% oil	—	—	11 5*	2 3	9 2	73	2 6	1·34	41
Palm kernel cake, 6% oil	—	—	8 17	0 18	7 19	75	2 1	1·12	17
„ „ meal, 6% „	—	—	9 0*	0 18	8 2	75	2 2	1·16	17
„ „ „ 2% „	—	—	8 2	0 19	7 3	71	2 0	1·07	17
Feeding treacle	—	—	6 10	0 8	6 2	51	2 5	1·29	2·7
Brewers' grains, Dried ale	—	—	6 17	0 19	5 18	49	2 5	1·29	13
„ „ „ porter	—	—	6 7	0 19	5 8	49	2 2	1·16	13
„ „ Wet ale	—	—	0 16	0 7	0 9	15	0 7	0·31	4·8
„ „ „ porter	—	—	0 12	0 7	0 5	15	0 4	0·19	4·8
Malt culms	—	—	6 5†	1 8	4 17	43	2 3	1·20	16

* At Hull. † At Bristol. ‖ At Liverpool

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £9 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 7d. P_2O_5, 8s. 10d. K_2O, 3s. 0d.

moisture) are equivalent to 25 lb. of beet tops (containing 83·8 per cent. of moisture).

REPLACEABILITY OF MANGOLDS BY SUGAR BEET TOPS

	Dry matter	Starch equivalent	Digestible protein
	lb.	lb.	lb.
40 lb. mangolds	4·30	2·20	0·28
25 lb. sugar beet tops . .	4·05	2·14	0·36

The precautions which should be observed when sugar beet tops are fed to farm animals will form the subject for discussion in the Notes for next month.

* * * * * *

MISCELLANEOUS NOTES

Home Produce in Empire Displays.—A note on the display of home produce at the Advertising Exhibition, held at Olympia in July, appeared in this JOURNAL last month (p. 395). A photograph of the stand is reproduced opposite. The Exhibition attracted large crowds, and a considerable amount of business was done by firms contributing to the Great Britain stand. It is confidently hoped that the interest shown in home produce will be sustained, and that a corresponding benefit will accrue to the industry.

Empire Marketing

An Empire Exhibition was held at Edinburgh from July 27 to August 6. A small stand was erected by the Empire Marketing Board, and, on one side of this, an effective display of home produce was arranged by the Ministry through the usual channels (photo opposite page). The Exhibition was well patronized, and much interest was evinced in some of the English products which are not so well-known in Scotland as they should be.

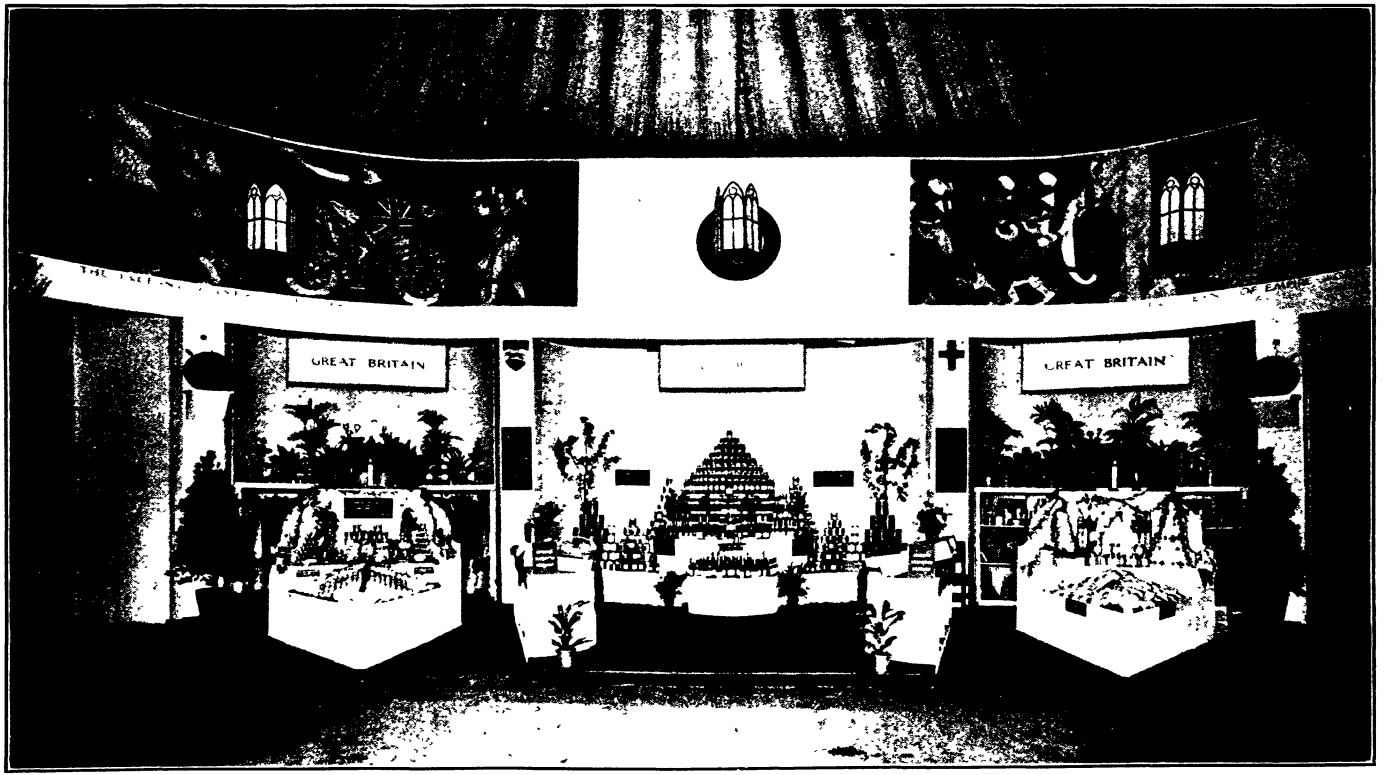
Empire Marketing Board Advertisements.—An article on this subject appeared in this JOURNAL last month (p. 444), with reproductions of three of the recent advertisements. Three further advertisements, which have appeared in the daily Press, are now reproduced, and also a photo of a 16-sheet poster in favour of home-grown fruit and vegetables.

* * * * * *

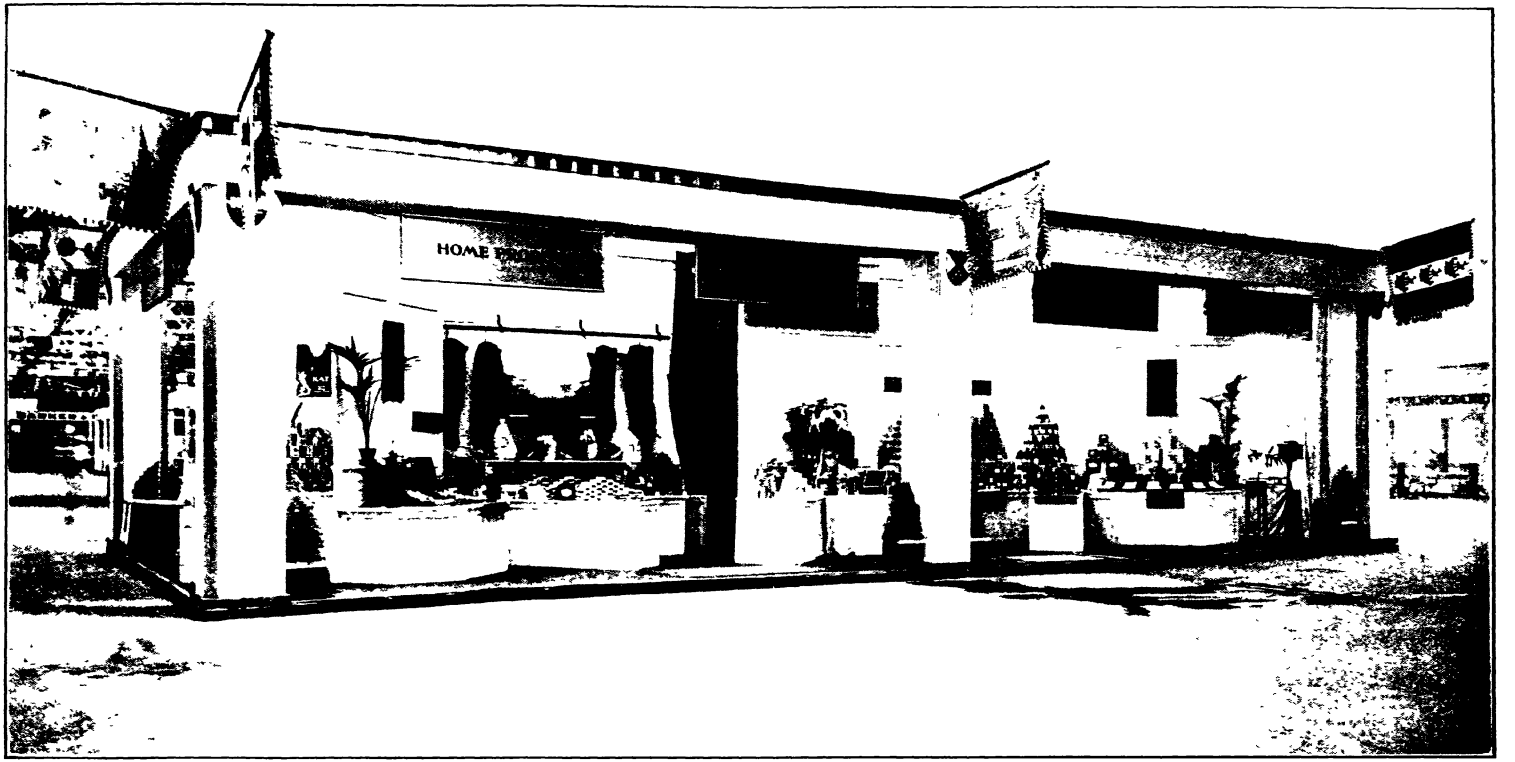
AMONGST the new nitrogenous fertilizers, now being manufactured in Germany, is a material known as Urea, which owing to its high content of nitrogen—46 per cent.—is of importance, if only for the saving which is effected in its transport.

Urea

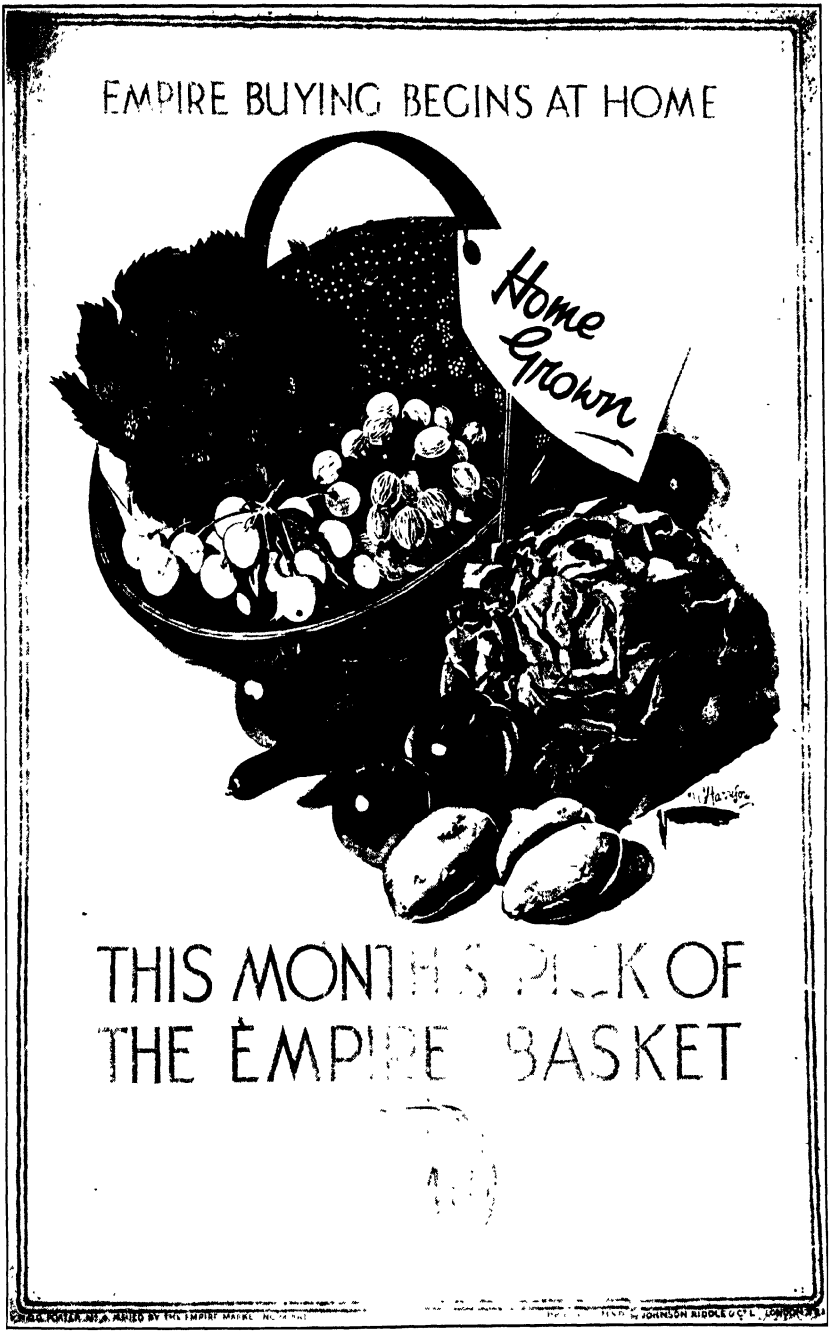
To face page 568.



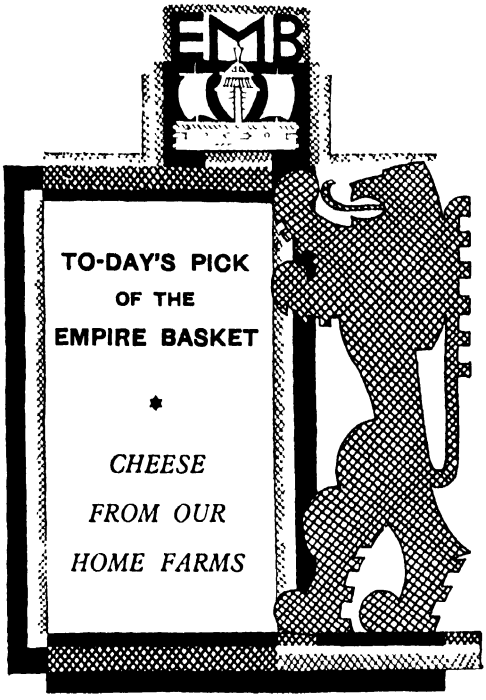
Display of Home Produce at the Advertising Exhibition, Olympia, London.



Display of Home Produce at the Edinburgh Empire Exhibition.



An Empire Marketing Board poster, favouring home-grown fruit and vegetables.



DO you know that cheese is one of the richest and most valuable foods that you can buy?

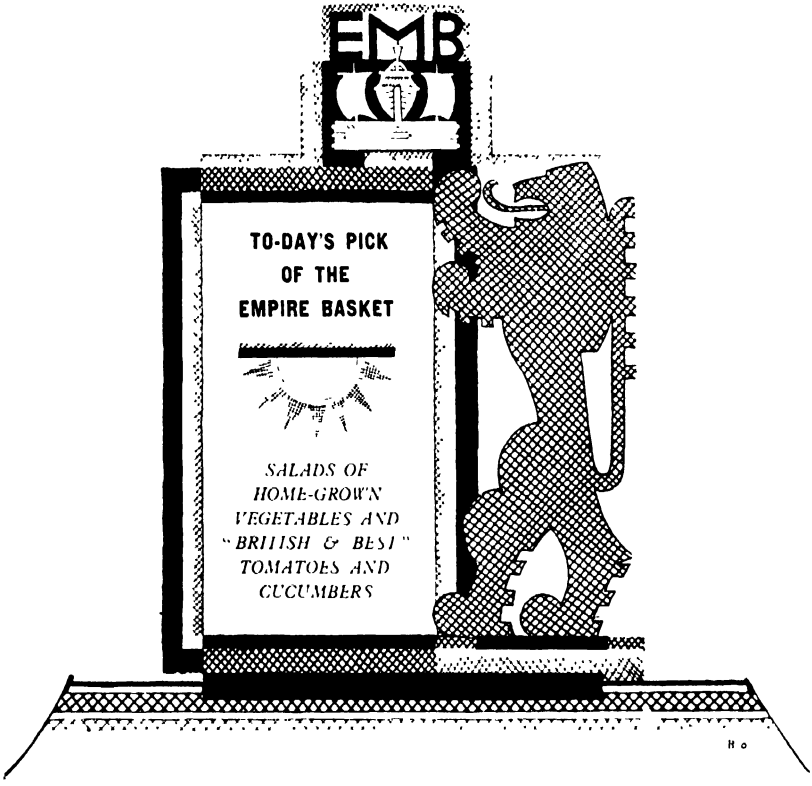
Our home cheeses have long been famous, and nowhere will you discover finer cheese than comes from our own countryside.

There is a variety to suit every taste and every purse.

Those who desire Cheshire Cheese of guaranteed origin and quality should note that Cheshire Cheese Manufacturers, under a scheme approved by the Ministry of Agriculture, now apply the trade mark ℭ (Choicest Cheshire Cheese) to their guaranteed produce

BUY
EMPIRE PRODUCE
from HOME and Overseas

ISSUED BY THE EMPIRE MARKETING BOARD



BUYERS OF THE SUN

You cannot grow a green plant in a dark room.

What does this mean to you? It means that every leaf in a green salad has the hall-mark of the sun upon it; and that when you buy lettuces and cresses, cucumbers and tomatoes for a salad, you are buying something else besides a delightful summer dish.

You are buying a store of sunshine against the dark winter days; and sunshine, as everyone knows nowadays, is the great enemy of ill-health and depression and disease

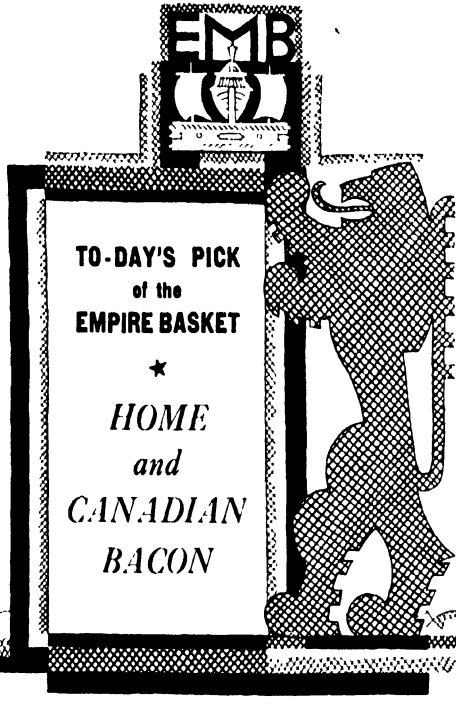
Buy your salad now, and insist that it is home grown

All produce sold under the trade mark "British and Best" is grown in English glasshouses. A recipe book on tomatoes and their many uses may be obtained free on application to the British Glasshouse Produce Marketing Association, Ltd., Sentinel House, Southampton Row, London, W.C.1

BUY EMPIRE PRODUCE

from HOME and Overseas

ISSUED BY THE EMPIRE MARKETING BOARD



THE PATRIOT AT THE BREAKFAST TABLE

We all of us like our bacon at breakfast to be attractive and appetising. It must be delicately sliced and carefully prepared and fried to a turn.

But do we ask where it comes from? Quality, after all, is the prime factor, and the bacon from the Home farms is of supremely high quality. We should first of all ask for the Home product; failing that we should resolutely demand Canadian bacon. For type of side and mildness of cure, its fine quality is now recognised. The Canadians know just as well as we do what good bacon is. And they send us of their best.

BUY EMPIRE PRODUCE

from Home and Overseas

ISSUED BY THE EMPIRE MARKETING BOARD

Small quantities of Urea have been imported into this country for experimental purposes, but its use has been handicapped by the fact that, up to recently, it has been subject to an Import Duty of 33⅓ per cent. *ad valorem* under the Safeguarding of Industries Act, 1921.

It is understood that steps are being taken which, it is hoped, will lead to the future manufacture of the material in this country; but, in the meantime, owing to an Order recently made by H.M. Treasury exempting it for a period—from June 27, 1927, to March 6, 1928—from the duty imposed by the Safeguarding of Industries Act, it is now possible to obtain supplies for use in this country at a cheaper rate than formerly.

* * * * * *

The Agricultural Index Number.

THERE has been appreciable variation in the prices of some classes of agricultural produce during July, but, as the alterations have usually been due to customary seasonal causes, the effect upon the index numbers has mostly been small. On the whole, there was a slight general improvement in the level of prices from 41 per cent. above pre-war in June to 42 per cent. for the month under review. A year previously, prices were 48 per cent. above the level of 1911-13.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922:—

	Percentage Increase compared with the Average of the corresponding month in 1911–13					
Month	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	—
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.—Higher prices have been realized for barley and oats, the former being 4d. per cwt. and the latter 2d. per cwt. dearer than in June, at 11s. 9d. and 10s. 2d. per cwt. respectively. The index figure for oats remained unchanged at 33 per cent. above the level of July, 1911-13, while that for barley was three points higher at 57 per cent. Wheat was slightly cheaper

at 56 per cent. above pre-war, the higher prices realized in June not having been fully maintained.

Live Stock.—The index numbers for both fat and store cattle were five points higher than in June at 30 per cent. and 26 per cent. above pre-war respectively, prices having been almost maintained whereas it is usual for some decline in values to occur at this season. Some improvement was noticeable in the prices paid for dairy cattle, the average quotations rising by about 20s. per head, and the index figure advanced four points to the level of 25 per cent. above the base years. There was a slight fall in fat sheep prices to 45 per cent. above pre-war, and fat pigs showed a further decline, reductions of 7d. per stone for baconers and 8d. per stone for porkers causing the relative index figures to fall by 11 points to 43 and 49 per cent. respectively above pre-war. Store pig prices were 10 points lower at 80 per cent. above the level of 1911-13.

Dairy and Poultry Produce.—The customary rise in egg prices was experienced, the average increase of 1½d. per dozen leaving the index figure practically unchanged on the month at 31 per cent. above the pre-war level, which compares with 33 per cent. a year ago. Poultry continued plentiful and fowls and ducks were cheaper than in the previous month, but, as this is the usual trend of summer prices, the index figure was only one point lower at 52 per cent. above pre-war. Butter was ¾d. per lb. dearer than in June and 42 per cent. above 1911-13 while cheese prices, although slightly lower, were 58 per cent. above pre-war in the month under review as compared with 54 per cent. in the previous month. Both butter and cheese were considerably cheaper than in the corresponding month a year ago when they were 56 and 78 per cent. dearer than pre-war. Milk was 55 per cent. above the level of the base years as compared with 53 per cent. in June and 60 per cent. in July, 1926.

Other Commodities.—The change from old crop potatoes to first early varieties which occurs in July resulted in the average price increasing by nearly 30s. per ton, but as this increase was very similar to that which took place in the corresponding period of the base years the index figure remained at 61 per cent. above the level of 1911-13 as in the previous month. New potatoes were, however, considerably dearer than in July, 1926, when the index figure stood at only 21 per cent. above pre-war and dearer also as compared with the prices ruling in July, 1925, when a level of 43 per cent. was recorded.

Hay prices advanced a little on account of the poor prospects for the new crop, but at 6 per cent. above the base years the index figure is two points lower than in July, 1926.

Index numbers of different commodities during recent months and in July, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	July	July	Apr.	May	June	July
Wheat	47	73	52	53	60	56
Barley	34	17	41	46	54	57
Oats	34	33	18	27	33	33
Fat cattle	48	40	25	24	25	30
Fat sheep	79	59	53	53	48	45
Bacon pigs	51	83	61	58	54	43
Pork pigs	52	84	73	66	60	49
Dairy cows	50	38	26	24	21	25
Store cattle	42	33	23	23	21	26
Store sheep	115	82	40	38	53	55
Store pigs	53	139	108	99	90	80
Eggs	61	33	37	28	30	31
Poultry	75	52	25	41	53	52
Milk	57	60	63	53	53	55
Butter	73	56	43	42	41	42
Cheese	70	78	36	46	54	58
Potatoes	43	21	60	74	61	61
Hay	0	8	- 1*	2	3	6
Wool	32	23	34	31	33	40

* Decrease.

* * * * * *

Farm Institute Courses

A REVISED leaflet (Form No. 732/T.E.) showing the types of instruction which will be available at Farm Institutes during the session of 1927–28 has been issued by the Ministry. The leaflet gives the names of the farm institutes, a short description of the courses at each, the fees payable, either for tuition only, or for board, lodging and tuition, as the case may be, and the address to which inquiries for further particulars should be sent. Two new institutes have recently been opened, *viz.*, the East Sussex Agricultural Institute, Plumpton, and the Pibwrlwyd Farm Institute, Carmarthen.

Copies of the leaflet may be obtained free of charge, and post free, on application to the Ministry, 10 Whitehall Place, London, S.W. 1.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended June, 1927, compared with the corresponding period in 1926. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	April to June, 1927		April to June, 1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	104	17,809	89	14,258
Belgium	34	837	0	0
Colombia.. .. .	2	130	0	0
Denmark..	0	0	2	150
France	0	0	10	785
Uruguay	13	3,200	13	2,300
Irish Free State.. ..	1,828	24,526	1,637	19,565
Kenya Colony	12	904	3	143
Nyassaland	0	0	6	260
Union of South Africa ..	0	0	13	800
Australia..	46	6,943	0	0
Other countries	7	590	18	575
Total of Cattle	2,046	54,939	1,791	38,836
SHEEP AND LAMBS				
Argentina	4	100	2	30
Brazil	0	0	6	190
Ecuador	0	0	7	56
Germany..	2	70	3	55
Peru	9	158	0	0
Spain	2	24	15	125
Irish Free State.. ..	100	268	448	737
Australia..	65	1,121	0	0
Other countries	3	95	11	85
Total of Sheep and Lambs	185	1,836	492	1,278
SWINE				
Argentina	3	120	5	162
Czecho-Slovakia ..	4	84	0	0
Denmark	4	20	0	0
France	7	301	0	0
Germany..	8	82	18	534
Italy	0	0	5	92
Netherlands	0	0	5	150
Poland	4	100	0	0
Japan	10	636	0	0
Irish Free State.. ..	368	1,153	409	2,040
Other countries	6	180	3	80
Total of Swine	414	2,676	445	3,058

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1927.

ACREAGE UNDER CROPS AND GRASS AND NUMBERS OF LIVE STOCK ON HOLDINGS ABOVE ONE ACRE IN EXTENT IN ENGLAND AND WALES AS RETURNED BY OCCUPIERS ON JUNE 4, 1927.

(The figures for 1927 are subject to revision.)

CROPS AND GRASS.

Distribution	1927	1926	Increase		Decrease	
	Acres	*Acres*	*Acres*	*Per cent.*	*Acres*	*Per cent.*
TOTAL ACREAGE under all CROPS and GRASS ..	25,589,000	25,676,000	—	—	87,000	0·3
*ROUGH GRAZINGS ..	5,125,000	5,063,000	62,000	1·2	—	—
ARABLE LAND ..	10,310,000	10,548,000	—	—	238,000	2·3
PERMANENT GRASS :						
For Hay ..	4,318,000	4,358,000	—	—	40,000	0·9
Not for Hay	10,961,000	10,770,000	191,000	1·8	—	—
TOTAL ..	15,279,000	15,128,000	151,000	1·0	—	—
Wheat	1,636,000	1,592,000	44,000	2·8	—	—
Barley	1,051,000	1,148,000	—	—	97,000	8·4
Oats	1,748,000	1,864,000	—	—	116,000	6·2
Mixed corn ..	110,300	114,400	—	—	4,100	3·6
Rye	35,800	47,900	—	—	12,100	25·3
Beans, harvested as corn ..	189,400	201,700	—	—	12,300	6·1
Beans, picked or cut green ..	12,100	12,600	—	—	500	4·0
Peas, harvested as corn ..	77,100	72,700	4,400	6·1	—	—
Peas, picked or cut green ..	41,600	46,400	—	—	4,800	10·3
Potatoes ..	514,300	499,400	14,900	3·0	—	—
Turnips & swedes	715,700	767,000	—	—	51,300	6·7
Mangold ..	305,600	338,500	—	—	32,900	9·7
Sugar beet ..	221,700	125,800	95,900	76·2	—	—
Cabbage for fodder, Kohl-rabi and rape ..	129,100	135,900	—	—	6,800	5·0
Vetches or tares	80,600	97,000	—	—	16,400	16·9
Lucerne.. ..	44,200	47,000	—	—	2,800	6·0
Mustard for seed	37,900	45,500	—	—	7,600	16·7
Cabbage for human consumption ..	26,000	25,400	600	2·4	—	—
Brussels sprouts	23,700	25,500	—	—	1,800	7·1
Cauliflower or broccoli ..	11,800	13,300	—	—	1,500	11·3

* Mountain, Heath, Moor, Down and other rough land used for grazing

CROPS AND GRASS—*continued.*

Distribution	1927	1926	Increase		Decrease	
	Acres	*Acres*	*Acres*	*Per cent.*	*Acres*	*Per cent.*
Carrots	8,900	8,300	600	7·2	—	—
Onions	1,700	1,900	—	—	200	10·5
Celery	5,700	5,400	300	5·6	—	—
Rhubarb ..	6,800	6,400	400	6·2	—	—
Linseed	2,500	2,800	—	—	300	10·7
Hops	23,000	25,600	—	—	2,600	10·2
Small fruit ..	69,300	69,500	—	—	200	0·3
Orchards ..	248,800	240,700	8,100	3·4	—	—
CLOVER and ROTATION GRASSES:						
For hay ..	1,585,000	1,578,000	7,000	0·4	—	—
Not for hay ..	875,000	924,000	—	—	49,000	5·3
TOTAL ..	2,460,000	2,502,000	—	—	42,000	1·7
BARE FALLOW ..	422,800	417,700	5,100	1·2	—	—

The total acreage returned this year as under crops and permanent grass on agricultural holdings exceeding one acre in extent in England and Wales is 25,589,000 acres, a reduction of 87,000 acres as compared with 1926. Some 62,000 acres more land has, however, been classified as rough grazings, so that the total area of land coming within the scope of the returns shows a decrease of only 25,000 acres.

During the past year more land has been laid down to permanent grass. The acreage of arable land is 10,310,000 acres, or 238,000 acres less than in 1926, and practically 690,000 acres or 6 per cent. less than in 1914.

Cereals.—The acreage of wheat shows a further increase this year, the total of 1,636,000 acres being 44,000 acres greater than in 1926 and 136,000 acres more than in 1925. Most of the eastern and north-eastern counties increased their areas, Norfolk and Essex showing additions of 7,000 acres each, while Lancashire and Cheshire with additions of 6,800 and 3,400 acres have increased their wheat areas very considerably, the additions in the latter two counties being about 35 per cent. and 25 per cent. respectively.

Although last year's area under barley was the lowest on record there is a further sharp reduction this year, the total acreage being only 1,051,000 acres against 1,148,000 acres in 1926. As compared with 1914 the barley area is about one-third less. Practically every county reduced its area, but there was an increase in the south-western counties. Norfolk shows a decrease of 9,500 acres or about 5 per cent., but several other counties in the east have relatively sharper reductions. Essex reduced its area by 13,400 acres or 19 per cent., and Suffolk shows a decrease of 15,500 acres or 12 per cent. In Lincoln (Lindsey) the proportionate decrease was about the same as in Norfolk, but Kesteven reduced its area by 4,100 acres, or 8 per cent.

The area under oats has also been reduced appreciably, the total of 1,748,000 acres being 116,000 acres less than in 1926. Every county in England and Wales with one exception shows decreases, with relatively the smallest declines in the eastern counties.

Forecasts of the yields per acre of corn crops, based on the condition of the crops on August 1, suggest that the total production of wheat, barley and oats this year will be approximately as shown in the following table. It must be borne in mind that the forecasts of the yields were made when practically all the crops were still uncut and are consequently subject to revision.

	Forecast 1927 Tons	Production 1926 Tons
Wheat	1,407,000	1,304,000
Barley	819,000	916,000
Oats	1,336,000	1,490,000

Beans and Peas.—Although the total area of beans is 12,800 acres less on the year at 201,500 acres, the total is 10,700 acres more than in 1925. Some 4,400 acres more land is returned under peas for harvesting as corn, but the area for picking or cutting green is reduced by 4,800 acres to 41,600 acres. The total area of peas, 118,700 acres, is the smallest recorded with the exception of 1916.

Potatoes.—The area under potatoes shows a further small addition this year, the total acreage of 514,300 acres being 14,900 acres more than in 1926. This is the first year since 1922 in which the acreage of potatoes has exceeded half a million acres. Most counties increased their areas, but the Isle of Ely and Huntingdon show decreases of about 10 per cent. Lincoln shows a relatively small increase and Norfolk a small reduction, while Lancashire and Cheshire practically repeat last year's areas. The West Riding of Yorkshire, however, increased its area by nearly 10 per cent. and Durham and Essex each added 16 per cent.

Sugar Beet.—A further very substantial increase in the acreage of sugar beet falls to be recorded this year, and the total of 221,700 acres is 95,900 acres larger than in 1926, and fully four times that of 1925. Norfolk now has over 51,000 acres under this crop, an increase of practically 19,000 acres on the year; Suffolk is growing nearly 36,000 acres, an increase of 10,900 acres, and Lincolnshire 32,000 acres, an increase of over 15,000 acres. There are relatively very large additions in Yorkshire and Salop, the total in the whole of Yorkshire this year being 17,000 acres against only 5,100 acres in 1926, while Salop now has 10,000 acres against only 2,300 acres last year.

Fodder Roots.—The acreage of turnips and swedes is 715,700 acres, or 51,300 acres less than last year, and the smallest area ever recorded. There has been a relatively sharper reduction in the mangold area, the total of 305,600 acres being nearly 10 per cent. less than in 1926, and the lowest figure recorded for over fifty years. A few counties in Wales show small increases in their mangold areas, but there are only two counties in the whole of the country which do not show reductions in their areas of fodder roots.

Other Crops.—All the other farm crops are being grown on reduced areas this year. The decrease in the case of hops is about 10 per cent., the total area being 23,000 acres. Mustard for seed shows a decrease of 7,600 acres, but the total of 37,900 acres is 15,000 acres greater than in 1925. Vetches cover 80,600 acres, or 16,400 acres less than in 1926; lucerne shows a decrease of 2,800 acres, or 6 per cent., and rye is being grown on 12,100 acres, or 25 per cent. less than last year.

Vegetables.—The area of carrots has been increased by 600 acres to 8,900 acres, but onions show a further decline of 200 acres to 1,700 acres. Celery shows a further increase to 5,700 acres, and rhubarb now occupies 6,800 acres, an increase of 400 acres on the year. Following last year's increases, brussels sprouts and cauliflowers were returned

as occupying reduced areas at the beginning of June, but the former occupied considerably more land than in 1925.

Fruit.—The total area of orchards is returned at 248,800 acres, an increase of 8,100 acres. Kent, with an addition of 2,200 acres, and Worcester and Hereford, with additions of over 1,000 acres, show the largest increases. There is practically no change in the total of 69,300 acres of small fruit, but strawberries have been heavily reduced, and currants and gooseberries increased. All the most important counties for strawberries show reductions, and the total of 23,200 acres is 3,200 acres less than last year. Most counties increased their areas of currants and gooseberries, Kent adding 1,100 acres and Norfolk nearly 800 acres, the total in the country being 35,500 acres, or 3,500 acres more than in 1926. The raspberry area at 6,500 acres shows little change.

Clover and Rotation Grasses and Meadow Hay.—The total area of clover and rotation grasses is 2,460,000 acres, a decrease of 42,000 acres on the year. Some counties, mostly on the eastern side of the country, however, have increased areas this year. The whole of the decrease is in that used for grazing, the area of "seeds" hay being 1,585,000 acres, or 7,000 acres more than in 1926. The area of meadow hay is, however, reduced by 40,000 acres to 4,318,000 acres, but some counties in the north and extreme south-west of England and in Wales show increases.

Bare Fallow.—There is a small increase in the area returned as bare fallow this year, the total of 422,800 acres being 5,100 acres larger than in 1926. Changes vary considerably in the different counties, but the eastern division shows an increase of 7,100 acres, or 5 per cent. The difficulty in working heavy land during the long spring drought may be responsible for this increase.

LIVE STOCK

CATTLE

	1927	1926	Increase		Decrease	
	No.	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Cows and heifers in milk ..	2,096,400	2,065,100	31,300	1·5	—	—
Cows in calf, but not in milk ..	307,100	294,600	12,500	4·2	—	—
Heifers in calf ..	387,100	389,600	—	—	2,500	0·6
Other cattle :—						
Two years and above ..	1,060,100	1,052,900	7,200	0·7	—	—
One year and under two ..	1,226,100	1,221,400	4,700	0·4	—	—
Under one year..	1,198,200	1,229,500	—	—	31,300	2·6
TOTAL OF CATTLE	6,275,000	6,253,100	21,900	0·4	—	—

The total number of cattle shows an increase of 21,900 as compared with last year's figure, which was the highest recorded up to that date. The total of 6,275,000 is 321,000 above the average of the ten years 1917-26. The increase was practically confined to the north of England and Wales, most counties on the eastern side of the country and in the south showing reductions. It may be noted that the changes were in the opposite direction last year, when practically all the

decreases were confined to the north and Wales. The number of cows and heifers in milk or in calf also again constitutes a record, the total of 2,790,000 being 41,300 larger than in 1926. Changes in the numbers vary appreciably in the different counties, increases being heaviest in the north of England and in Wales. Calving heifers at 387,100 show a decrease of 2,500, but this class increased by 11,100 last year. The number of cattle under one year has been reduced by 31,300 to 1,198,200, but this year's figure has seldom been exceeded, except during the war. The number of feeding cattle (other cattle above two years old) has been increased by 7,200, while yearlings also show a small addition.

SHEEP

	1927	1926	Increase		Decrease	
	No.	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Ewes kept for breeding ..	6,958,600	6,754,800	203,800	3·0	—	—
Other sheep :—						
One year and above ..	2,832,100	2,890,700	—	—	58,600	2·0
Under one year	7,279,500	7,213,200	66,300	0·9	—	—
TOTAL OF SHEEP	17,070,200	16,858,700	211,500	1·3	—	—

A further increase is recorded in the number of sheep, but the rate of increase is much smaller than in the previous four years, and, apart from Wales and the north of England, most counties show reductions. The total number is 17,070,200, or 211,500 more than in 1926, and only 60,000 less than in 1913. The increase is relatively greater in breeding ewes than in the total of sheep and lambs, there being 6,958,600 ewes against 6,754,800 in 1926. Most counties increased their breeding flocks, but 17 counties spread over the midlands, eastern and southern counties show decreases. The increase in lambs was only 66,300, against the addition of 203,800 to the breeding flocks. Other sheep above one year old declined by 58,600 to 2,832,100, the bulk of the counties showing decreases.

PIGS

	1927	1926	Increase	
	No.	*No.*	*No.*	*Per cent.*
Sows kept for breeding	392,500	300,800	91,700	30·5
Other pigs	2,294,800	1,899,200	395,600	20·8
TOTAL OF PIGS ..	2,687,300	2,200,000	487,300	22·1

There has been a sharp increase in the number of pigs on agricultural holdings, and last year's decrease has been more than wiped out. The total number returned is 2,687,300, or 487,300 more than in 1926, and, apart from 1924, is the highest number recorded since 1904. Every county in England and Wales shared in the increase. There is a relatively sharper addition in breeding sows than in other pigs, an indication that breeding was probably still being increased when

the returns were collected at the beginning of June. Breeding sows number 392,500, or 91,700 more than last year, and an increase of over 30 per cent. This is the largest number recorded with the exception of 1924 and 1895, since sows were first separately distinguished in the returns in 1893. Every county increased its number of breeding sows

HORSES

	1927	1926	Decrease	
	No.	*No.*	*No.*	*Per cent.*
Horses used for agricultural purposes (including mares for breeding)	746,200	760,600	14,400	1·9
Unbroken horses (including stallions) :—				
One year and above	107,200	125,200	18,000	14·4
Under one year ..	40,200	41,000	800	2·0
Other horses	183,600	202,000	18,400	9·1
TOTAL OF HORSES	1,077,200	1,128,800	51,600	4·6

The number of horses on agricultural holdings shows a further reduction this year, but it should be noted that the sharp decline in breeding has been nearly stopped. The number of foals is 40,200, or only 800 less than last year. The greater part of this decrease is in foals described as light, the decrease in heavy foals being only 100, and several counties, more particularly in Wales and the north of England together with Cornwall and Devon, record increases in this class of foal. Horses used for agricultural purposes are reduced in practically every county, the total being 746,200, against 760,600 last year. The decrease in " other horses " would not have been so appreciable but for the fact that a number of pit ponies not normally on farms were included in the returns last year. As compared with 1925 " other horses " are reduced by 14,000.

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on July 27 and August 9, Mr. W. B. Yates, C.B.E., presiding in the absence of the chairman, Lord Kenyon.

The Board received notifications from the following Committees of decisions fixing minimum and overtime rates, and made Orders carrying these decisions into effect :—

Dorset.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from August 28 (when the existing rates are due to expire) until further notice. The minimum rates in question are in the case of male workers of 21 years of age and over 30s. per week of 51 hours in summer and 48 hours in winter, with overtime at 8d. per hour, and in the case of female workers of 15 years of age and over 5d. per hour, with overtime at 6d. per hour.

Suffolk.—An Order fixing special minimum rates of wages for male workers employed on the corn harvest in 1927. The special minimum rates in question in the case of male workers employed on farms of at least 60 acres of corn are for such workers of

21 years of age and over employed throughout the corn harvest on harvest work a sum of £5 for the period in addition to the ordinary minimum weekly wage, and in the case of workers of similar age who are employed for a part only of the corn harvest 10d. per hour for all employment on harvest work. In the case of farms of less than 60 acres of corn the special minimum rate for male workers of 21 years of age and over is 10d. per hour for all employment on harvest work.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board, 7 Whitehall Place, S.W. 1.

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Enforcement of Minimum Rates of Wages.—During the month ending August 15 legal proceedings were instituted against five employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines	Costs	Arrears of wages	No. of workers
		£ s. d.	£ s. d.	£ s. d.	
Hereford	.. Ledbury ..	8 0 0	2 0 0	13 16 6	3
Devon ..	.. Barnstaple ..	—	—	16 10 0	1
Montgomery	.. Llanfair Caereinion ..	—	0 9 0	28 8 11	1
Northants	.. Peterborough Liberty ..	2 0 0	2 2 0	5 1 4	1
Pembroke	.. Narberth ..	2 0 0	2 12 0	To be agreed	2
		£12 0 0	£7 3 0	£63 16 9	8

* * * * * *

Foot-and-Mouth Disease.—One further outbreak of foot-and-mouth disease has been confirmed since the August issue of the JOURNAL, *viz.*, at Hunton, near Maidstone, Kent, confirmed on July 27 on premises in close proximity to the original Hunton outbreak confirmed on July 19.

No further outbreak having occurred in the Staffs (Wigginton) area restrictions in this area were withdrawn on August 8. Infected area restrictions are now in force in one small area only, of about two miles' radius round Hunton, Kent, and, in the absence of developments, these restrictions will be withdrawn by August 24.

Twenty-seven outbreaks in all have been confirmed since January 1 last, involving nine counties and the slaughter of 1,175 cattle, 893 sheep and 366 pigs.

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NOTICES OF BOOKS

The Agricultural Landowner's Handbook. By R. Strachan Gardener, F.S.I. Foreword by Lord Clinton. Second edition. Pp. 178. 1927. (London: Central Landowners' Association, 7 Charles Street, St. James's, S.W. 1. Price 5s. net.)

According to the official report on the Agricultural Output of England and Wales, recently issued, it is estimated that over 25 per cent. of the agricultural holdings in this country are owned by their occupiers. In the cases of owners of large estates it is often difficult enough to deal satisfactorily with the many involved and technical questions arising out of the ownership of the land. When an owner-occupier of a farm is faced with these problems, he may well be appalled by

the prospect, and he may feel compelled to spend time and money which he can ill spare in obtaining legal advice as each knotty point develops.

It was apparently to provide, for large and small owners alike, a handy and convenient book of reference that the *Agricultural Landowner's Handbook* has been written, and its main sections, dealing with income tax, super tax, land tax, local rates, tithe rentcharge, death duties, including succession and legacy duties, give an indication of the scope of the work. Much useful information is embodied as to the bases of assessment, etc., and the method of compilation adopted is to state what are the facts with regard to these various outgoings and charges, the information being given in a form easily understandable by a layman. Reference to legal cases and the use of legal terms has been restricted as far as possible, with a corresponding increase in clarity. Each of the subjects dealt with is, in itself, of sufficient importance and complexity to demand a large text book for detailed treatment, but in the handbook under review a successful attempt has been made to condense the whole of the information required by an agricultural owner under each heading within the limits of a handbook of a size which can be slipped into the pocket for convenient reference. It is obvious that the author has been at great pains to select the best books of reference and to consult the various Acts of Parliament, regulations, etc., relating to the subjects with which he deals, and has summarized the information so obtained in a form which should prove extremely useful to all owners of agricultural land. The price at which it is published should render the handbook available to a considerable number of occupying owners who purchased their holdings during recent years, when so many large agricultural estates were being broken up.

Sugar Beet : Costs and Returns for the Year 1925-26. By A. Bridges and R. N. Dixey. (Oxford : Agricultural Economics Research Institute. Price 2s. 6d.)

This monograph forms a sequel to a similar study by the same writers for the 1924 crop, and contains the results of an inquiry into the financial and economic aspects of the sugar beet crop for the latest year for which complete information is at present available. The fifty-three costs on which the study is based have been grouped according to variations of soil and district, and the costs of the crop both for land and materials are discussed in turn. Considerable attention has been given to a detailed study of the labour costs for each stage of the cultivation of the crop. Comparisons are also drawn between the results of the two years.

A chapter is devoted to the question of the risk of failure, and another deals with the various means adopted in disposing of the tops and leaves. The value to the farmer of those by-products, according to the methods of utilization, has been estimated. The difficulties encountered by farmers before deciding to buy pulp from the factories are also touched upon, and a table is given showing the value of the subsidy.

Throughout the book attention has been drawn to points which seem to offer scope for improvement and, in the concluding statement, the authors mention some of the difficulties confronting the future development of the industry.

Animal Nutrition and Veterinary Dietetics. By R. G. Linton. M.R.C.V.S. (Edinburgh : W. Green & Son, Ltd. 1927. Pp, xii + 399. Price 21s. net.)

It has been a pleasure to read and review this admirable treatise by Professor Linton. The title of the book might suggest that it has been

written solely with the object of meeting the requirements of the student of veterinary science. This, however, is by no means the case, as a survey of the summary of contents will readily prove. It is in every sense a book which should be in the possession of all who are in any way concerned with the sound and economical feeding of domestic animals.

It may be recommended to the stockowner, because the treatment of the subject is broad and lucid and displays an intimate and a sympathetic understanding of the manifold difficulties which the feeder of animals must encounter in the pursuit of his calling. The reader, even though his store of science be small, will not fail to gain a substantial insight into the scientific principles underlying successful feeding and management. It may also be recommended to the scientific reader, because Professor Linton has written with a fine sense of the value and significance of the most recent research in animal nutrition. Here is a book which may fairly claim to be up-to-date, at least so far as this is possible in an age when an overworked Press is scarcely able to keep pace with the onward march of scientific discovery.

The work is divided into six main sections. Section I deals with the composition and functions of feeding stuffs; those much discussed questions of the rôle of minerals in nutrition and the mineral requirements of farm animals are discussed very comprehensively in this section. Section II is devoted to an unusually thorough and interesting description of the composition, properties and uses of all the possible feeding stuffs which are likely to be encountered on any farm in the kingdom. Section III introduces the reader very simply to the various methods which are in use for assessing the productive values of feeding stuffs. A brief fourth section is given over to a consideration of the problems involved in the preparation and storage of foods, this leading up to a highly important section in which the principles underlying feeding and management are dealt with in great detail. Professor Linton's interests show a wide range in this section, the subjects dealt with including the rearing of calves, the fattening of cattle and the feeding of dairy cows, horses, pigs, sheep, dogs and poultry. The sixth and final section, entitled "Some Harmful Foods," constitutes a useful concluding feature.

In the preparation of this volume, Professor Linton has enjoyed the assistance of several colleagues, who have contributed chapters on subjects in which they are specially interested. The book is none the less valuable on this account. Such is the opinion of Professor Linton himself, who states in the preface that "the utility of the book and any success it may achieve will be due in no small measure to their co-operation."

The work is generously illustrated and has been splendidly arranged and printed. To the publishers and the printers, no less than to the author and his collaborators, congratulations may be offered for the production of a really notable addition to nutritional literature.

Chinese Agriculture. *Die Chinesische Landwirtschaft.* By Dr. Wilhelm Wagner. (Berlin: Verlagsbuchhandlung Paul Parey, Hedemannstrasse, 10 & 11 1926. Pp. xv+668. 204 illustrations and two maps. Price 42 Reichsmarks.)

The author, in March, 1911, arrived from Germany to take charge of the agricultural section of the German-Chinese College at Tsingtau, on the bay of Kiao-chau, then a German protectorate. The sole apparatus he found on arrival was a blackboard and a piece of chalk. In August, 1914, the outbreak of war saw him in possession of a well-equipped agricultural institute, with valuable collections, a laboratory with

three permanent assistants, a 15-acre experimental field, and a representative stock of animals. From 1915 to 1920, as a prisoner of war in Japan, he had full opportunity of working up his materials. On his return to Germany he was unable to take up the work again until 1924. The success of his efforts at Tsingtau is enough in itself to arouse great expectations of the book before us, expectations that will not be disappointed. He has made good use of his eyes and has read widely—witness a bibliography of over 200 entries.

The first two chapters of this work describe minutely the climate and soil of the six divisions into which China, in these respects, naturally falls. The next section, of four chapters, discusses the influence of the social and economic conditions of the people on agricultural production. The agriculture of prehistoric China presents a marked analogy to that of early Babylonia, though the link between the two civilizations would seem to have been broken at a very early period. A significant mark of the independence of Chinese development is the fact that though the Chinese had cattle since the remotest times, and though they were frequently invaded by milk-drinking nomads, they never themselves took to milk. As regards implements, their ploughs, which lack mould-boards—unless that name should be given to a plate set across the direction of motion—turn the soil but imperfectly, and that only when they are tilted over to one side. They are constructed of wood or iron, or both, according to the material available in the district. Traction is supplied by buffaloes or, on poorer holdings, by human kind. Their harrows, rollers and soil pressers are primitive types. China, as was said of Egypt, is a sphere of machine-saving man.

The chief manure is human fæces, though canal mud and composts of various kinds are used. The ploughing under of leguminosæ is understood, and grass, weeds and young shrubs are collected and ploughed in. Ashes are also used. What we call artificials are not used at all. Drills are primitive in design—a kind of double funnel discharging into furrows cut by two small shares—the implement being drawn by men or by an animal. As regards rotations, the Chinese get the utmost out of the land, using wheat, beans, etc., as nurse crops for cotton. Rice is of course a staple crop. Every form of thrashing is employed: treading out by stock, flail and primitive machines.

The latter half of the book describes the various field and orchard crops grown and the stock raised by this patient and industrious people. Among the former, rice, soya beans, sweet potatoes, oil plants, cotton and tea are of special interest; of the latter, the section on silkworms is naturally attractive. A chapter on costings rounds off the work. The book is excellently printed in roman type; the illustrations, of which there are some 200, are clear and instructive; there are two helpful maps, one orographical, the other geological. German books are not always easy reading, even for those who know German well. This book is written in the simple style of the eye-witness, and its perusal should not present much difficulty to any reader with an average knowledge of the language. The interest of its well-informed pages will fully reward the effort.

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Tomato Growing in Scotland. *D. VHowells.* (Scottish Jour. Agric., x, 3 (July, 1927), pp. 280-292+3 pl.) [63.513.]

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Horns versus Polls. *Sir R. Greig* and *A. D. Buchanan Smith.* (Scottish Jour. Agric., x, 3 (July, 1927), pp. 263-271+4 pl.) [63.62.]

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Feeding versus Manuring for Beef Production During the Grazing Season. *W. G. R. Paterson.* (Trans. High. Agric. Soc., Scotland, XXXIX. (1927), pp. 60-73.) [63.33-16; 63.62 : 043.]

Baby Beef. An Investigation into the Production and Consumption of Beef in the United Kingdom with Special Reference to Early Fattening. *A. N. Duckham.* (Jour. Roy. Agric. Soc., Eng., 87 (1926), pp. 123-177.) [63:62; 63.62 : 043; 63.75.]

Bulk in Animal Feeding. *F. Procter* and *N. C. Wright.* (Jour. Agric. Sci., XVII, 3 (July, 1927), pp. 392-406+1 pl.) [612.394; 63.6043.]

The Nutritive Value of Dried Spent Hops. *W. L. Davies* and *R. S. Sullivan.* (Jour. Agric. Sci., XVII, 3 (July, 1927), pp. 380-387.) [63.60432; 63.60433.]

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Review of Recent Work on the Nutrition of the Pig. *J. B. Orr* and *A. Crichton.* (Trans. High. Agric. Soc., Scotland, XXXIX. (1927), pp. 25-41.) [612.394; 63.64 : 043.]

Pig Problems. *T. A. Stephens.* (Trans. High. Agric. Soc., Scotland, XXXIX. (1927), pp. 74-78.) [63.64.]

The Relation of Prices to Production of Pigs. *A. W. Ashby* and *J. Morgan Jones.* (Jour. Roy. Agric. Soc., Eng., 87 (1926), pp. 67-86.) [338.5; 63.6 : 38; 63.64.]

The Marketing of Live Stock. *F. J. Prewett.* (Jour. Roy. Agric. Soc., Eng., 87 (1926), pp. 57-67.) [63.6 : 38.]

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NOTES FOR THE MONTH

Unemployment Insurance

UNDER the Unemployment Insurance Act, 1920, employment in agriculture, including horticulture and forestry, is specifically excluded from ranking as an insurable occupation. No definition of the precise classes of workers covered by this general exclusion is, however, contained in the Act, and from time to time reference is made to the High Court for decision in regard to particular forms of employment.

In this connexion the following report of a judgment in the High Court is reproduced from the September issue of the *Ministry of Labour Gazette* :—

> On July 29, 1927, judgment was given in the High Court on questions referred by the Minister of Labour as to the liability to insurance under the Acts of six persons employed by horticulturists or nurserymen, growers of fruit, tomatoes, plants and flowers, which were sold either to florists or to buyers in Covent Garden or other markets. The employees, one man and five women, were employed in connexion with the cultivation and preparation for market of these products. The women workers were in some cases engaged for the whole year, and in other cases for particular seasons only. Their work consisted in preparing the products of their employers for sale, *e.g.*, by trimming and washing the plants, selecting and bunching cut flowers, grading the fruit and tomatoes, and packing for despatch all these products. The man was employed as a foreman in superintendence over such of these operations as were necessary in the establishment of his particular employers.
>
> The Judge held that the employment of all these persons was employment in horticulture, and was, therefore, excepted from the provisions of the Acts under paragraph (*a*) of Part II of the First Schedule to the Act of 1920. They were, therefore, not required to be insured.
>
> In the course of his judgment the Judge intimated that he had been asked by Counsel for the Ministry of Labour and Counsel for the National Farmers' Union that he should, if he found it possible, formulate a general rule applicable to the industries of agriculture and horticulture for the purposes of the working of the Unemployment Insurance Acts in the class of case under reference. In response to this request the Judge laid down the

undermentioned formula, but he explained that he did so with some reluctance as it was difficult, if not impossible, to forecast what cases might arise in future. He also added the reservation that he could only state a working rule such as he would adopt himself, on his present information, and such as he would regard as open to correction and modification if circumstances made it necessary or desirable. The rule is as follows :—

Persons are employed in agriculture and horticulture when employed upon any operations done about the production, preparation or transfer of the products of farm or garden or orchard in the best saleable condition to a first buyer or to a salesman or agent for sale if one be employed, or to a distinct business under one proprietorship as in Daniels' case. But if the industrial status and occupations of the employed persons are such that, though they are working about or in connexion with a farm or garden or orchard they may properly be said to be essentially pursuing their own special occupations, they are not employed in agriculture or horticulture within the meaning of this rule.

In the Daniels' case mentioned in the rule it was held that a person employed in a factory, sorting peas which were to be sown again for testing purposes, was employed in horticulture. It was pointed out in the judgment, however, that the employers in this case were horticulturists, that is to say, nurserymen and seed growers, and also seed merchants, and that, in common with other seed merchants, they no doubt had other employees who were not employed in horticulture.

* * * * * *

Potatoes for Seed in the Irish Free State

THAT close on half a million acres in the Irish Free State are planted with potatoes gives some idea of the importance of this crop to that small country. Ireland has long been famous for its potato culture, and the fact that many old varieties, such as "Champion," "Up-to-Date," "British Queen," "Beauty of Hebron," and "Early Rose," which have almost gone out of cultivation in England and Scotland, are still widely planted, suggests that varieties are able to maintain their vigour longer under the Irish climate and the Irish methods of cultivation than has been found possible in this country. As the belief is now generally held that the deterioration of stocks of potatoes in England is due, in most cases, to the effect of Leaf Roll and Mosaic, it would seem either that these virus diseases do not cause as much damage in Ireland or that they are not prevalent there. If this be true, it would seem that Ireland should become a very important source for the supply of healthy stocks of seed potatoes.

Ireland, especially Northern Ireland, did raise in former years a considerable quantity of potatoes for seed purposes,

and had an export trade of some size to the western ports of England and Wales, to Malta and other parts of the world, but, during the troubled times of 1916-1920, the Irish trade became indifferent to the class of seed exported and, consequently, Irish seed potatoes came to be looked upon as of very uncertain character. Since 1920, however, a definite attempt has been made by Dr. Murphy* on the research and experimental side, and by Mr. W. D. Davidson† on the field side, to effect a steady improvement in the class and standard of potatoes grown for seed purposes, and their efforts have met with a very considerable measure of success.

Dr. Murphy's work, on Leaf Roll, Mosaic, and virus diseases of potatoes, generally, is well known and widely accepted. He has tested numerous stocks of potatoes in Ireland, ascertained their freedom from these diseases, and grown sample plots which he believes are quite free from troubles of this kind. Mr. Davidson, realizing that the varieties of potatoes ordinarily grown were not the kinds usually in demand for seed purposes by English and Scottish growers, has endeavoured to improve matters by persuading certain potato growers in the Free State to plant "King Edward," "Majestic," "Sharpe's Express," and other varieties favoured in the British markets. In some instances the seed for this purpose was obtained from Scotland, and care was taken, both by Dr. Murphy and by Mr. Davidson, that only specially selected stocks, which had been awarded a super-certificate by the Board of Agriculture for Scotland, were taken over to Ireland for seed raising. In addition, the Irish Free State started a scheme of inspection and certification, in which a very high standard is set; and if this standard is achieved in practice, the class of seed exported should be a very good one.

Generally, the areas in which Dr. Murphy and Mr. Davidson are attempting to get seed potatoes raised fall into two distinct groups—(*a*) the Dundalk region and County Donegal, where main crop varieties are grown, and (*b*) the Athlone district, where early varieties are grown. Main crop and early varieties are also grown in County Sligo.

In Donegal, the potatoes are grown by smallholders on a fairly red, loamy soil, and so should have a good appearance when sold in bulk. The potatoes growing there this year were

* Of the Albert Agricultural College, Glasnevin, near Dublin.

† Of the Department of Lands and Agriculture, Irish Free State.

chiefly of the main crop varieties, such as "King Edward," "Up-to-Date," "British Queen," "Arran Chief," "Great Scot," "Arran Consul," and "Kerr's Pink," although smaller quantities were to be seen of "Majestic," "Epicure," and "Sharpe's Express," and there were, also, a few patches of Mr. McKelvie's new seedling, "480" ("Arran Banner").

At the beginning of July, active spraying operations were in progress as a preventive measure against blight, which had not then appeared, the ordinary knapsack sprayer being used, and Burgundy Mixture of the double strength which is so common in Ireland. The time for roguing had not then arrived, but an inspection of the fields showed that the purity of the crops, in most cases, was particularly satisfactory, and in no single instance would the rogues have amounted to more than 1 per cent. of the crop. No case of Leaf Roll was seen, and both Dr. Murphy and Mr. Davidson aver that this disease does not exist in the Free State except in districts where much imported seed has been planted. Some crops looked practically free from Mosaic, but, generally speaking, the mild forms of Mosaic, and even the more serious form (Crinkle) could be found in most crops, although the percentage present in crops to be offered for certification was inconsiderable. Crops not grown for seed purposes were considerably affected with diseases of the Mosaic type, although the conditions at the time the crops were seen certainly favoured the detection of Mosaic.

Blackleg, however, was present in larger quantities than are normally found in the potato fields in this country, and it is to be hoped that this disease will receive serious consideration by all those concerned.

For marketing the seed produced in Donegal, the potatoes are packed in special bags, which are sealed in the presence of an inspector, and are distributed through a selected merchant, with whom it is wiser to deal than to trade direct with the small growers.

In the region around Dundalk, a few growers are also specializing in the production of seed potatoes, and will offer their fields for inspection and certification. In fields of "Great Scot," "Arran Chief," "Arran Consul," "British Queen," and "Majestic," inspected at the beginning of July, the standard of purity and health was similar to that of the potatoes in Donegal, although these crops were then more backward and had produced less haulm. A large acreage of

potatoes grown in County Sligo, by Sir Josslyn Gore-Booth, of Lissadell, was also examined. It included such varieties as "King Edward," "Great Scot," "Arran Consul," "Epicure," and "Arran Chief." These, also, were very true to type and quite free from Leaf Roll, but somewhat infected with Mosaic and Blackleg.

In the Athlone district, the potatoes are grown by small-holders, cultivating small fields of black, peaty soil in the Bog of Allen. It is not an early district, but, since 1900, early varieties have been grown for seed purposes, and, at the time of inspection, early varieties predominated, "Epicure," "Sharpe's Express," "Beauty of Hebron," "Duke of York," and "May Queen," being the main crops growing, although, here and there, some later kinds, such as "King Edward," "British Queen," and "Great Scot" were being tried. On the fields seen, the varieties were very pure, with practically no rogues; the crops were quite free from Leaf Roll, although a little Mosaic was present and some Blackleg. No blight was apparent, and spraying was in progress. The crops in this area, again, were extremely satisfactory, and the district should be suitable as a source of seed.

Irish growers who are not producing specially for seed purposes under the Free State Government Scheme, take little or no trouble in roguing; the varieties were very much mixed and Mosaic diseases and Blackleg prevalent. Growers here, therefore, should be very careful about purchasing the Free State seed other than that certified by the Government, and marketed in sealed bags in accordance with the official scheme.

* * * * * *

Clean Milk Competitions

THESE competitions have now been put into practice in over forty counties in England and Wales by the Local Education Authorities, in accordance with the Scheme outlined in the Ministry's *Guide to the Conduct of Clean Milk Competitions*,* and the movement has extended therefore throughout practically the whole of the country.

A report on clean milk competitions held in 1924-25,† which dealt in detail with all aspects of the movement, was issued

* Miscellaneous Publications, No. 43. Price 4d. post free, direct from the Ministry.

† Miscellaneous Publications, No. 56. Price 4d. post free, direct from the Ministry.

County	Competitions April, 1925 -March, 1926				Competitions April, 1926 -March, 1927			
	No. of competitors	Total No. of cows	No. of samples examined	No. of samples reaching graded standards	No. of competitors	Total No. of cows	No. of samples examined	No. of samples reaching graded standards
Berkshire ..	25	940	632	388	22	891	264	222
Buckinghamshire.	39	787	283	192	28	576	164	121
Cheshire	22	680	200	149	17	506	170	117
Cornwall ..	17	226	102	94	22	342	264	261
Cumberland and Westmorland ..	12	304	99	42	25	859	175	103
Devon	18	328	108	88	29	413	208	164
Dorset	21	750	168	84	33	1,160	384	181
Durham‡ ..	12	274	130	100	—	—	—	—
Essex	21	1,003	126	108	61	2,198	854	678
Gloucester ..	—	—	—	—	22	537	129	101
Hampshire ..	—	—	—	—	72	2,594	424	98
Hertford	28	960	224	125	33	1,280	264	238
Kent	32	825	813	542	32	850	429§	287§
Leicester ..	8	260	56	42	8	167	56	42
Kesteven ..	38	583	228	68	27	400	162	46
Lindsey	—	—	—	—	21	242	252	162
Middlesex ..	13	442	78	53	15	570	180	92
Northants ..	—	—	—	—	30	571	174	70
Northumberland .	10	227	90	60	24	504	206§	148§
Nottinghamshire .	21	431	245	143	17	345	204	130
Oxford	15	518	104	80	15	473	179	113
Rutland	—	—	—	—	13	237	94	45
Salop	10	327	60	32	17	493	102	76
Somerset ..	73	1,620	501	343	85	2,109	960	653
Staffordshire ..	—	—	—	—	20	616	120	113
Suffolk E. & W...	22	450	110	100	29	700	348	232
Surrey	37	852	363	234	39	1,132	470	357
Sussex East ..	97	2,300	369	65	68	1,929	204§	35§
Sussex West ..	32	859	279	145	40	1,047	475	316
Warwickshire ..	—	—	—	—	26	645	312	167
Wiltshire.. ..	97	2,773	553	330	50	2,016	639	450
Worcester ..	9	166	54	45	14	346	168	136
Yorkshire ..	21	534	231	133	28	442	252	220
Anglesey ..	—	—	—	—	9	238	81	51
Brecon & Radnor	10	186	90	88	—	—	—	—
Cardigan ..	—	—	—	—	24	269	198	150
Carmarthen ..	13	272	104	70	9	204	18	11
Denbigh	17	403	129	81	—	—	—	—
Flint	10	150	60	39	12	200	86	37
Montgomery ..	10	149	80	56	13	193	86§	64§
Pembroke ..	8	116	48	27	13	226	104	82
Total ..	818	20,695	6,717	4,146	1,062	28,520	9,859	6,569

‡ A further competition is in progress in Durham, but particulars are not included as it was not commenced until May, 1927. Derbyshire is also omitted from the statement as the scheme in that county is organized on modified lines, and the results are not therefore comparable. The Derbyshire scheme comprised five local short-time contests, lasting for about six weeks each, and covering approximately 100 competitors.

§ These competitions are still in progress and the figures given relate to samples examined up to the end of August, 1927.

by the Ministry in November, 1926, and the comparative statement on the opposite page, relating to competitions commenced during the years April, 1925-March, 1926, and April, 1926-March, 1927, indicates the considerable progress which has since been made.

Interim reports are issued to competitors relating to the results of bacteriological and chemical examination of samples, and giving the comments of the inspecting judges after their surprise visits. The chief educational value of the competitions, however, lies in the advisory service provided. In many cases clean milk demonstrations are held in association with the competitions, and in addition advisory visits are paid to all competitors by members of the staff of the Local Authorities for Agricultural Education. As a rule these advisory visits are distinct from the judges' visits of inspection, and the actual number paid in connexion with competitions commenced during the year 1925-26 was 2,913 ; the total number for the following year is not available, but it may be stated that, in general, an advisory visit was paid to each competitor at least three or four times—a sufficient indication of the extent of this service.

Instructors and judges, alike, commented favourably upon the keenness of competitors and employees, and the judges stated that whilst buildings in many cases were poor and equipment out of date, sound methods, with as light expenditure on utensils and improvization in plant, overcame obstacles and led to very good results.

Other notable features of the competitions were : (1) the number of samples of milk which, on examination, were found to reach the bacteriological standards required for Grade " A," or certified milk ; (2) the good keeping qualities of the majority of samples—in general the milk kept sweet and untainted for from two to four days—a factor which will be appreciated by all consumers ; (3) the improvement in methods and results between the first and last visits of the judges ; (4) the number of competitors who, where a market could be found for graded milk, took out graded licences as a direct result of the competitions ; and (5) the general good health of the cows.

Whilst there were six times as many competitors and cows included in competitions for the year 1926-27 as compared with 1923-24—a striking increase—they still represent only a minute proportion of the total dairying population of the country. The value of the competitions, however, lies not only in the work that is achieved but in the example that is

set to all producers of milk. The propagandist value of the competitions is also important, since the articles and notes on them which appear from time to time in the Press will tend to give the consumer confidence in the milk supply and probably lead to an increased consumption.

It has been demonstrated throughout the movement that, without expensive plant and specially constructed buildings, it is possible to produce milk of high hygienic quality which will keep well—and the "*open sesame*" is intelligent reception of advice offered by the dairy teaching staff of the Local Authorities for Agricultural Education.

In addition to clean milk competitions, 31 milking competitions were held during the year 1925-26, and 43 during 1926-27, either at Agricultural Shows or on the farms of competitors in the County Clean Milk Competitions.

* * * * * *

International Institute of Agriculture

WITH reference to the note in the May issue of this JOURNAL regarding the general organization and activities of the Institute, the first meeting of the International Scientific Council, which is sub-divided into 25 consultative Committees, is being held on November 7. The Institute announces that the preparatory work for this meeting is making good progress. The Permanent Committee has also decided to summon in the same month a meeting of the International Permanent Commission of Agricultural Associations, on which, at the present time, nearly 180 Agricultural Associations of various countries are represented. Consideration will be given at this meeting to the question of establishing more effective collaboration between the Institute and the Associations by means of a regular and systematic exchange of information and views.

In connexion with the World Agricultural Census to be taken in 1929-30, Mr. Estabrook, the Director of the Census, has been engaged for a number of months in visiting the authorities in various countries with the object of securing that the Census shall be taken on the general lines proposed by the Institute. In the April issue of this JOURNAL, it was stated that visits had already been paid to European and North African countries, with generally satisfactory results. Since then Mr. Estabrook has visited the competent authorities in the United States, Canada, Mexico, Cuba, Jamaica, Haiti

and San Domingo, all of which countries have notified their acceptance of the Institute's scheme.

The Fourth International Seed-Testing Conference will take place on May 18, 1928, at the Institute's offices in Rome, and will be preceded and followed by a meeting of the General Assembly of the International Seed-Testing Association.

The adherence of Bolivia brings the total number of adhering States to 74.

* * * * * *

Marketing of Home Produce : Report

ACCOUNTS have been given in this JOURNAL, from time to time, of the various activities of the Ministry, undertaken with the aid of the grant of £40,000 a year for five years made by the Empire Marketing Board for the purpose of carrying out further investigations into the marketing of home-grown agricultural produce, and for demonstrating improved methods. A further brief report of progress for the quarter ended June 30, 1927, may prove of interest.

Publications.—One report in the Economic Series has been issued during the quarter, namely, No. 13, *Markets and Fairs in England and Wales* (Part 1, General Review). With the aid of the grant this report was issued at 6d. net. Two other reports have been completed and are about to be sent to the printer, *viz.*, No. 14, *Markets and Fairs in England and Wales* (Part 2, Midland Markets), and No. 16, *The Marketing of Fluid Milk.*

The total sales of the reports in the Economic Series to June 30, 1927, are as follows :—

No.	Title	Total
1.	"Co-operative Marketing of Agricultural Produce in England and Wales"	2,196
2.	"The Stabilisation of Agricultural Prices"	1,100
3.	"The Economic Resources of Canada"	877
4.	"Large-scale Co-operative Marketing in the United States"	1,274
5.	"The Co-operative Purchase of Agricultural Requisites"	1,110
6.	"The Trade in Refrigerated Beef, Mutton and Lamb" ..	1,049
7.	"Wool Marketing in England and Wales"	1,152
8.	"Agricultural Credit"	1,646
9.	"Marketing of Potatoes"	1,101
10.	"Egg Marketing in England and Wales"	6,496
11.	"The Marketing of Poultry in England and Wales" ..	6,865
12.	"The Marketing of Pigs in England and Wales" ..	3,275
13.	"Markets and Fairs in England and Wales"	2,139
15.	"Fruit Marketing in England and Wales"	5,016
		35,296

Marketing Investigations.—Reports on the Marketing of Pig Products, on the Marketing of Apples, Pears and Plums, and on the Marketing of Cereals are in preparation. Investigations are also in progress into the Marketing of Cattle, Vegetables, and Cheese ; further inquiries necessary in connexion with the survey of markets are also proceeding.

Marketing Demonstrations.—Practical demonstrations of improved methods of marketing eggs, poultry, fruit, and pigs have been staged at the following Shows during the quarter : Oxfordshire, Bath and West, Suffolk, Three Counties, Royal Cornwall, and Lincoln. In addition to many verbal expressions of approval, written appreciation of these demonstrations has been expressed by, amongst others, the Imperial Economic Committee, by branches of the National Farmers' Union and by County Agricultural Organizers. Numerous requests have reached the Ministry for a repetition of the demonstrations at other Shows this year and next. A programme of demonstrations for the coming autumn and winter was published in this JOURNAL last month (page 496).

Displays of Empire Produce.—Adequate representation of home produce was arranged at the Exhibition of Empire Produce held at Belfast from May 23 to 28 ; a full account was given in this JOURNAL for June (page 193) and July (page 380).

Grants-in-Aid.—A grant of £100 has been offered to the *British Fruit Packing Company*, East Farleigh, Kent, on condition that the company supplies the Ministry with certain information in respect of the quantity of fruit and vegetables received at the company's packing stations, the costs of handling, the records of consignments to markets, gross and net returns, market charges, etc. The grant is to be used only in payment, or part payment, of the salary of an additional employee, whose primary duty will be to keep the records required.

A grant not to exceed £150 has been approved towards the expenses of a scheme for marketing black currants, initiated by the *Norfolk Fruit Growers, Ltd.* The grant is only in respect of the payment of marketing, secretarial and supervisory expenses, and no part is to be used for advertisement. Records showing the quantities consigned to, and the gross returns from, each market, and details of the net costs of consignment to, and sale in, each market are to be kept, and audited accounts are to be furnished.

A grant of £200 a year has been approved to the *School of Agriculture, Cambridge,* for an experimental trial of pig recording in conjunction with the St. Edmundsbury bacon factory.

A grant not exceeding £1,000 has been offered to and accepted by the *Pershore Co-operative Fruit Market* to enable that society to embark upon a scheme for marketing graded produce. Audited accounts, records of the produce handled and of the handling costs, together with records of expenses and receipts from sales, are to be kept and are to be available for inspection.

The Ministry has reserved the right in each instance to publish such of the above information as may be of general interest and utility.

Egg Marketing Poster.—The interest in the large poster calling attention to the points to be observed when marketing eggs has been sustained, and requests for copies are still being received. The issue of the poster has led to requests for large numbers of Marketing Leaflet No. 3, to which reference was made in a previous report.

Packages for Eggs and Dressed Poultry.—The Report of the Committee which was appointed to examine the various packages in use in the trade in this country in home-produced eggs and dressed poultry has been summarized in the form of a leaflet (No. 5 in the Marketing Series). Over 2,000 copies have already been distributed to the agricultural and trade Press, to the various organizations of producers and distributors connected with the industry and to education authorities likely to be interested. The recommendations of the Committee have received favourable comment from every quarter. An abridged edition of the leaflet has been prepared for general distribution on a large scale.

* * * * * *

Cheddar Cheese

THE English Cheddar Cheesemakers' Federation has been formed with the object of placing on the market a standardized and trade-marked product. The Federation has appointed two graders, who will examine all Cheddar cheese submitted to them; and will affix the trade-mark of the Federation to such cheese as satisfies the standard laid down. This standard requires 88 per cent. of points to be obtained, points being awarded for flavour, texture, keeping qualities, colour and finish. The scheme was put into operation on August 1, when

the Duke of Somerset stamped the first cheese to be passed by the official grader. The trade-mark applied for consists of two "C's" with the word "Cheddaration" crossing them. It is understood that the farmers in the Cheddar district are joining the Federation in considerable numbers, and the trade-marked cheese is meeting with a good reception by traders.

This scheme, like that of the Cheshire Cheese Federation, is a great advance in marketing technique, and, in the belief that the experience gained will be of the highest value to all branches of the industry, the Ministry has sanctioned a grant to the Cheddar Federation of a sum not exceeding £700 for the first year of working, in order to assist them over the financial difficulties inherent in the inauguration of experimental schemes of this nature. The grant will be made from the fund placed at the Ministry's disposal by the Empire Marketing Board, and is to be used towards administrative expenses only. The Federation has undertaken to supply full information and accounts from time to time, which the Ministry will be at liberty to publish for the information and guidance of producers generally.

* * * * * *

Beet Sugar

AT the outset of the fourth manufacturing season since the passing of the British Sugar (Subsidy) Act, it is opportune to review briefly the progress that has been made in the industry in this country.

In 1924 there were only 22,637 acres under sugar beet, and in the ensuing manufacturing campaign only three beet sugar factories were at work—Cantley, Kelham and Colwick. These factories sliced in that season 183,713 tons of beet, giving a production of 23,915 tons of white sugar. Each succeeding campaign has seen the opening of new factories, until the number about to commence work on this year's crop is no fewer than 19, of which five will operate for the first time and five will have greatly enlarged their manufacturing capacity since the previous campaign. The total area under sugar beet in 1927 is returned at 229,200 acres—221,700 in England and Wales and 7,500 in Scotland. Should the yield per acre be approximately that of 1926, namely, 8·6 tons—though there is no reason why, with added experience, the British yields should not more closely correspond in the future to Continental and United States averages—it would be

reasonable to expect a total crop of about 2,000,000 tons of beet, and a production of white sugar of, say, 260,000 tons, or a little less than two months' supply of sugar for Great Britain. Should this forecast prove correct, the direct payments to farmers by the factories in respect of the 1927 crop will be nearly £6,000,000.

The following statement illustrates the development that has taken place :—

	Manufacturing Season			
	1924-5	1925-6	1926-7	1927-8 (Estimated)
Acreage under sugar beet	22,637	56,243	129,463	229,200
No. of factories	3	9	14	19
Sugar beet delivered to factories (tons) ..	183,713	431,185	1,117,072	2,000,000
Total production of sugar (cwt.)	478,308	1,035,672	3,069,739	5,200,000
Total production of molasses (cwt.)	114,015	270,910	750,000	1,300,000

* * * * * *

Red Squill as a Rat Poison

THE Ministry advocates the use of red squill poison in baits intended for the destruction of rats and mice, in preference to other stronger poisons sometimes used, such as strychnine, arsenic and phosphorus. Red squill is particularly recommended for use on farms and in places where, owing to the presence of poultry, live stock, domestic animals or stored food supplies, special care is necessary.

Red squill poison is extracted from the red squill bulb (*Urginea maritima*) which grows on the sandy shores of the countries bordering the Mediterranean Sea. It may be used in powdered or liquid form in baits consisting of bread (or oatmeal), fat, syrup and a few drops of aniseed, or in biscuit or other forms supplied by firms who deal in rat destruction preparations and appliances.

From experiments recently carried out on behalf of the Ministry, the following general conclusions were arrived at :—

(*a*) Female rats are killed by doses of red squill approximately only half as great as those generally needed to kill male rats.

(*b*) The finer the red squill powder is ground the more toxic it becomes.

(*c*) The best red squill baits for general use are those made from a finely ground and completely dried product of the bulb itself.

(*d*) The average lethal dose for male and female rats is, approximately, ·50 and ·27 grammes respectively.

(*e*) The white squill (used for medicinal purposes) is useless as a rat poison.

A series of experiments was also carried out with calves, sheep, pigs and rabbits, which were given red squill powder in their feed, and, in spite of the fact that they had been given no other food for the preceding 24 hours, it was found almost impossible to induce the animals to eat any appreciable quantity of the poisoned feed. It would appear, therefore, that on the grounds of palatability alone, there is little danger of such animals eating a sufficient quantity of red squill baits to cause ill effects. In those cases where the animals were induced to take the poison, it was found that unless a considerable quantity of the poison was consumed no ill effects were noticed. Experiments with fowls showed that they took the poison more readily, but even then it was found that to kill a fowl required a dose between 20 and 30 times as large as that necessary to kill a rat.

These experiments appear to show that, while fatal to rats, red squill poison is comparatively harmless to larger animals, and Rat Officers are urged to consider the desirability of using preparations containing this toxic agent, particularly in those cases where domestic animals and poultry are kept in the vicinity.

* * * * * *

Visit of Royal Commission on Land Drainage to Holland

THE Royal Commission on Land Drainage, which was appointed earlier in the year under the chairmanship of Lord Bledisloe, to inquire into the present law relating to land drainage and report whether any amendment of the law is needed to secure an efficient system of arterial land drainage without any undue burdens being placed on any particular section of the community, has already heard evidence from most parties interested and has visited a few typical areas (such as the lowlands in Somersetshire and our Eastern Counties) where an efficient system of drainage is necessary to preserve the land from permanent waterlogging.

The Commissioners recently made arrangements, at the invitation of the Netherlands Government, to inspect the Dutch systems of drainage and reclamation and study their administration. They left for Holland on the night of Sunday, September 18, and were received next morning by the Minister of Waterstaat, who is responsible for the regulation of the level of the waters of Holland. Short lectures on drainage problems were given, followed by an inspection of the coast defence works south of the Hague. For this inspection and

for the whole of their tour, the Commissioners were under the guidance of Jonkheer van Panhuys, the Chief Engineer of the Dutch Ministry, Mr. J. Korthals-Altes (a Dutch expert on drainage problems in several European countries, who has, moreover, written a biography of Sir Cornelius Vermuyden, who came over to England from Holland in the seventeenth century and planned the huge schemes of artificial drainage which are still in existence in the Cambridgeshire fens and the Isle of Axholme), and Mr. Laming, the British Commercial Secretary at the Hague.

The second day was spent in inspecting the great national work of the Netherlands, the reclamation of the Zuiderzee. On that day members of the Royal Institution of Netherlands Engineers were visiting the Zuiderzee works with a number of French engineers, and they invited the British Royal Commissioners to join the party.

On the following day, the Commissioners were received by the Queen's Lieutenant of Overijssel, and under his guidance inspected various inland drainage areas and uplands, where, although no pumping is necessary as in the case of the coastal districts, water from the higher levels flows into the lower lands, thereby threatening them with serious deterioration. The last day of the visit was spent in inspecting the estuary of the River Ijssel, which flows into the Zuiderzee between long training walls, similar to those which it is proposed to build into the Wash to improve the drainage of the area served by the River Ouse.

Throughout their tour, the Commissioners received every assistance from the Dutch authorities and the staff of the British Legation, the unfailing courtesy of both having afforded opportunities for the acquisition of very useful knowledge in the most pleasant manner possible.

* * * * * *

FIELD EXPERIMENTS AT ROTHAMSTED DURING 1925-1926—I

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As in previous years, many of the experiments have dealt with fertilizers, and have been designed to find out why fertilizers act well in some seasons and places and not in others. The variation in effectiveness is not the same for all; the nitrogenous manures give fairly steady increases each year, even though the seasons vary considerably, while both for phosphatic and potassic fertilizers the increases may be high in some seasons and low in others. Thus in recent years the increases in yield of potatoes in cwt., per acre at Rothamsted for one cwt. of manure supplied have been :—

Fertilizer	1922	1923	1924	1925	1926
Sulphate of ammonia	20	22-25	20	23	25
Sulphate of potash—					
No farmyard manure ..	58	25	10	40-46	—
Farmyard manure	20	10	0	—	20-23

Basal manure was given in addition.

Although there have been no experiments with phosphatic fertilizers on potatoes at Rothamsted (these are being started during the current season) there have been experiments on swedes, and these also show much variation in effect from year to year; the increase in cwt. per acre for the dressing of 600 lb. superphosphate per acre were :—

1913	1920	1922	1924
44	140	18	30

The variation in effect is not simply a matter of chance, it depends on the season; and it so happens that the phosphates and potash act best in a bad season when additional crop is a great advantage. This is well brought out in the further details given in the following table showing the yield of swedes in tons per acre :—

	Poor years		Good years	
	1913	1920	1922	1924
No artificials	3·2	3·3	25·2	17·3
No phosphate but only sulphate of potash and sulphate of ammonia	6·4	9·3	28·1	19·1
Phosphate in addition (slag 1922, or super. 1924)	8·6	16·3	29·0	20·6

Both phosphate and potash may, therefore, be regarded as insurance against loss; for in the bad season, when roots are scarce, the value of an extra 7 tons, or even of an extra 2¼ tons, per acre is well worth an effort to secure.

Again, phosphatic and potassic fertilizers are important in keeping up the fertility of the soil. Wherever supplies of farmyard manure are restricted, the productiveness of the land falls off considerably unless phosphatic and potassic fertilizers are periodically added. This is shown in the following yields of barley grown in the same field (Little Hoos), part of which received no phosphate while other plots received periodical dressings of superphosphate :—

BARLEY : BUSHELS PER ACRE.

	Phosphate given	No phosphate given since 1904	Fall in yields
1909 ..	40·60	36·6	4 after 5 years
1914 ..	37·32	23·27	14 after 10 ,,
1922 ..	37·80	20·25	17½ after 18 ,,

The broad result is, therefore, that nitrogenous manures increase the growth of crops in almost any season, while phosphates and potash may not act in a good season, especially if farmyard manure is plentifully given ; but they may act well in bad seasons or when farmyard manure is scarce, and in any case they are needed for keeping up the productiveness of the land.

Manuring of Potatoes.—The experiments on the manuring of potatoes bring out the important point that the fertilizers do not give their best action unless they are made up to give a complete manure. The effect on the potato crop of sulphate of ammonia, with and without sulphate of potash was tried both in 1925 and 1926. With no sulphate of potash the sulphate of ammonia had only little effect ; 1 cwt. per acre produced no increase in crop, 2 cwt. gave 1½ tons of potatoes, and 4 cwt. gave no more. But as soon as sulphate of potash was added the yields rose with every additional quantity of sulphate of ammonia ; the first cwt. gave one extra ton of potatoes ; the second gave a further ton and a half ; while two more cwt. gave up to two additional tons according to the amount of sulphate of potash supplied. The figures for 1926 are :—

Sulphate of ammonia ..	0	1	2	4 cwt. per acre
0 cwt. sulphate potash per acre	7·8	7·7	9·4	9·5 tons potatoes
1 ,, ,, ,,	7·8	9·0	10·6	11·2 ,, ,,
2 ,, ,, ,,	8·0	9·2	10·3	11·6 ,, ,,
4 ,, ,, ,,	7·8	9·1	10·4	12·3 ,, ,,

Standard error : 5·48 per cent.

Relation between Quantity of Fertilizer Supplied and Amount of Crop Yield—The table set out above shows the relation between the amount of fertilizer and the crop yield. The

largest crop was given by the largest dressing of fertilizer, but it does not follow that still larger dressings would have given still larger crops. This point was tested in 1925 when the yields were :—

Sulphate of ammonia ..	0	2	4	6 cwt. per acre
0 cwt. sulphate potash per acre	5·54	5·22	6·44	— tons potatoes
2 ,, ,, ,,	7·25	9·18	10·18	— ,, ,,
4 ,, ,, ,,	7·92	10·54	10·96	— ,, ,,
6 ,, ,, ,,	—	—	10·95	10·47 ,, ,,

No farmyard manure was given.
Standard error : 4·27 per cent.

The highest yield the season permitted was about 11 tons per acre, and this was obtained by the use of 4 cwt. per acre each of sulphate of ammonia and sulphate of potash. Increasing these dressings to 6 cwt. each per acre gave no further advantage. One of the most important factors in successful manuring is to recognize that fertilizers added beyond a certain point do not increase the crop and may only involve the farmer in loss. It seems clear, however, that under-manuring is also likely to cause loss of profit. In the 1926 experiments (p. 601), for example, the additional crop obtained by the use of an extra cwt. of sulphate of ammonia per acre was as follows :—

Sulphate of ammonia ..	1	2	3 & 4	cwt. per acre
1 cwt. sulphate potash per acre	23·6	31·6	6·0	cwt. potatoes
2 ,, ,, ,,	23·2	22·6	13·2	,, ,,
4 ,, ,, ,,	24·4	28·6	19·0	,, ,,
Mean	23·7	27·6	12·7	,, ,,

The first cwt. sulphate of ammonia gave an additional 23·7 cwt. of potatoes, the second cwt. gave an additional 27·6 cwt., a larger return than the first. The third and fourth cwt. gave less increase, however, varying from 6 to 19 cwt. according to the quantity of sulphate of potash, the heavier dressing having, as already pointed out, the greater need of potash. The falling off in effectiveness of the third and fourth cwt. is in accordance with the well-known Law of Diminishing Returns. The increased effectiveness of the second cwt., as compared with the first, is not, and shows that an increasing return precedes the diminishing return. Various other illustrations have now been accumulated at Rothamsted, and they indicate that the greatest profit is attained by pushing up the applications towards the point of Diminishing Returns rather than by keeping them too low.

The Balancing of Manures.—In recent years there has been considerable discussion as to the necessity or desirability of balancing manures for crops. Formerly a rather fine balance was thought desirable; experiment has shown, however, that this is not so, the plant having considerable power of adjustment to its surroundings. This point has been carefully tested with the potato crop, where the fertilizer mixture is very important. The results for 1926 have already been given (p. 602); those for 1925 are as follows :—

YIELD OF POTATOES, 1925.
In tons per acre.

Fertilizers	No sulphate of potash	Additional for		Gain per cwt. sulphate of potash for	
		2 cwt. sulphate of potash per acre	4 cwt. sulphate of potash per acre	1st 2 cwt.	2nd 2 cwt.
No sulphate of ammonia given ..	5·54	1·71	2·39	0·86	0·31
2 cwt. sulphate of ammonia given ..	5·22	3·96	5·31	1·98	0·68
4 cwt. sulphate of ammonia given ..	6·44	3·74	4·51	1·87	0·39

Both in 1925 and 1926, there is a curious fall in yield when 1 or 2 cwt. sulphate of ammonia is used alone without sulphate of potash. Not only is there no gain: the experiment shows an actual loss of 0·32 tons per acre in 1925 and 0·07 tons per acre in 1926. If these figures stood alone the loss might be doubted; we have, however, obtained the result before. The result is the same as that obtained in 1925, when the sulphate of ammonia was increased from 4 to 6 cwt. per acre, the sulphate of potash not being increased beyond 6 cwt. Here also there is no gain in yield but a loss of 0·48 tons per acre.

Within the safe amount of nitrogen there is no evidence of a rigidly defined "best" ratio of nitrogen to potassium for a potato fertilizer. In 1925, 2 cwt. sulphate of potash and 4 cwt. sulphate of ammonia are inferior to 4 cwt. sulphate of potash and 2 cwt. sulphate of ammonia, the difference being 0·35 tons per acre, *i.e.*, 7 cwt. per acre. In 1926, the reverse happens: 2 cwt. sulphate of potash and 4 cwt. sulphate of ammonia give 1·2 tons per acre more potatoes than 4 cwt. sulphate of potash and 2 cwt. sulphate of ammonia. But although no rigid ratio can be prescribed, the general result emerges in both years that equal weights of sulphate of potash

and sulphate of ammonia in the mixture give, on the whole, better results than any other mixture. It should be noticed that this contains more potash than is usually present in potato manures.

Compensating Effects of Phosphates and Potash in Bad Seasons. The Maximum Crop obtainable by the use of Fertilizers.—It is a commonplace that the effects of fertilizers vary with the different seasons; as we have seen the nitrogen is the most constant in action, but the phosphate and potash vary from year to year. The variation is of special interest because both fertilizers are better in a bad season than in a good one; they thus act as compensators, pushing up the yields when bad weather conditions would make them low, but not much increasing them when good weather conditions keep them high. This compensating action is well seen in our potato experiments, where on the properly fertilized plots the yield varies far less than might be expected from season to season; the results have been :—

MAXIMUM CROP, POTATOES, ROTHAMSTED.

In tons per acre.

1922	1923	1924	1925	1926
9·5	10·6	13·3	11·0	12·3

The 1922 results are almost certainly low because the dressings of sulphate of ammonia then given did not exceed 2 cwt. per acre, a quantity now known to be insufficient. The figures show that, in any year, one may hope by the best scheme of manuring to arrive at about 11 to 13 tons of potatoes per acre, but the amount and composition of the manure required to attain this maximum vary from year to year. Several mixtures approach the maximum, but some more nearly than others, and for these the financial returns are better.

Both in 1925 and 1926, the best results are attained by 4 cwt. sulphate of potash and 4 cwt. sulphate of ammonia, and any reduction in amount of fertilizer leads to a reduction in crop. The man who wished to economize would, in 1925, have done better to begin with 4 cwt. sulphate of potash and add as much sulphate of ammonia as he felt disposed (up to 4 cwt.), but, in 1926, his best plan would have been to begin with 4 cwt. sulphate of ammonia and add as much sulphate of potash as he wished—again up to 4 cwt.

Experiments with Cereals.—In the manuring of cereals, it is not usually necessary to give a complete fertilizer because there should be sufficient potash and phosphates applied to

the roots, potatoes or seeds ley in the rotation to furnish all that is necessary. Exceptions occur on thin chalk soils, where potash may be required, or on the Norfolk soils and the Lincolnshire and Yorkshire Wolds, where phosphates are often given; but over large tracts of country a nitrogenous fertilizer is alone required for wheat, oats or barley. This is shown by the following results :—

AVERAGE INCREASE IN YIELD OF BARLEY IN BUSHELS PER ACRE, GIVEN BY 1 CWT. SULPHATE OF AMMONIA PER ACRE, 1925.

	With potash and phosphates	Without potash or phosphates	No of centres
Total grain ..	7·38	6·94	10
Dressed grain ..	7·12	7·09	8

The most suitable nitrogenous manures are nitrate of soda, nitrate of lime, sulphate of ammonia and cyanamide, and the proper time of application is in the spring. For spring-sown corn, the manure naturally goes in with the seed, but for winter corn it must be given as a top dressing, and then the difficult question arises, When should the manure be applied? Late application has led to larger crops and an increased proportion of nitrogen in the grain; it has also given dark green, unhealthy looking foliage. The latter is undesirable; the higher nitrogen content might be valuable in wheat, oats or feeding barley, but is not wanted in malting barley. Further information is wanted before general rules can be given, and the experiment is being carried on for a period of years.

For winter oats in 1925 the results were as follows :—

Treatments Basal (2 cwt. superphosphate)+	Time	Yield of grain bushels per acre	Yield of straw cwt. per acre	Total produce lb.
No nitrogen	—	49·6	23·5	4717
1 cwt. sulphate of ammonia ..	Early	59·4	31·8	6057
1 cwt. sulphate of ammonia ..	Late	64·2	30·8	6142
2 cwt. sulphate of ammonia ..	Early	66·4	36·7	6902
2 cwt. sulphate of ammonia ..	Late	69·3	34·6	6780

The early dressing was applied on March 5 and the late on May 5.

The effect of 1 cwt. sulphate of ammonia has, therefore, been to give the following increases :—

	1st cwt.	2nd cwt.	Increase for 2 cwt.
Applied early	9·8	7·0	16·8
Applied late	14·7	5·0	19·7

This is a general average of 9 bushels of oats per acre, which is not far from the figure obtained in 1923 (8·3 bushels) and

above the usual average for oats, 7 bushels; it shows the degrees of similarity of action of nitrogen in spite of the differences in season.

The experiment is very similar, so far as the treatments are concerned, to one made on the old lines in 1923, but the result differs in that the late dressing gave the larger yield for the second and not for the first cwt. of sulphate of ammonia. The gains were in that year in bushels per acre :—

	1st cwt.	2nd cwt.	Increase for 2 cwt.
Applied early	8·1	9·2	17·3
Applied late	5·4	19·1	24·5

The experiment was repeated more fully in 1926 with both wheat and oats. The wheat behaved like the oats of 1925 and 1923 in producing more grain for the late dressings than the early ones. The oats, however, grew so well (yielding 75½ bushels per acre without added nitrogen) that the sulphate of ammonia had but little effect, 1 cwt. increasing the yield by only 2 bushels per acre, and 2 cwt. doing no better. But the 77½ bushels thus obtained was the highest we have ever had and probably the maximum obtainable on our land. The yields were :—

Sulphate of ammonia, per acre	Oats, 1925		Oats, 1926		Wheat, 1926	
	Grain bushels	Straw cwt.	Grain bushels	Straw cwt.	Grain bushels	Straw cwt.
None	49·6	23·5	75·4	44·1	27·0	41·0
1 cwt. early ..	59·4	31·8	77·2	50·0	24·5	43·7
1 cwt. late ..	64·2	30·8	77·0	50·0	32·8	44·9
2 cwt. early ..	66·4	36·7	77·4	58·9	30·8	46·2
2 cwt. late ..	69·3	34·6	77·3	50·3	32·1	46·7
Standard error per cent. ..			2·78	0·76 for total produce 1·45		

All plots received a basal dressing of superphosphate, except wheat in 1926.

We are not yet prepared to explain why the late dressing was more effective than the earlier ones.

Cyanamide on Cereals.—Another interesting effect which is being followed up was obtained this year with cyanamide. Usually, nitrogenous fertilizers, in increasing the yield of grain, also increase the length of the straw and so tend to "lay" the crop. In this season's experiments, cyanamide, while increasing the grain as much as sulphate of ammonia, did not cause the straw to grow so long. Further, it caused

more tillering, *i.e.*, it increased the number of heads per plant, though it produced no more grain than sulphate of ammonia. It is improbable that the cyanamide itself brings about these effects, as it quickly decomposes in the soil; some other substance associated with it is more likely to be the agent. We are now studying the possibility of combining this result with one mentioned later: an increased number of grains per head brought about by using chlorides or muriates. If we could do this, we could hope to obtain more heads per acre and more grains per head, and therefore more yield of corn at no great expense.

Malting Barley Experiments.—The consumption of barley for purposes of malting increases each year. The quantities of malt used and the amount of barley estimated to be required is as follows, assuming, as is generally true, that 4 cwt. of barley give 3 cwt. of malt.

Year ended September 30	Malt used in brewing cwt.	Malt used in distilling cwt.	Total malt cwt.	Estimated equivalent in barley of total malt cwt.
1923	10,742,000	3,242,502	13,984,502	18,647,000
1924	11,275,235	3,105,525	14,380,760	19,174,000
1925	11,453,591	3,056,601	14,510,192	19,347,000

About 75 per cent. of this barley is grown at home and the rest is imported, but there is no reason, in the nature of things, why a larger proportion should not be supplied by the British farmer. Over a run of seasons, the financial return is satisfactory, although there are sometimes marked differences between the price offered by buyers in different parts of the country for the same sample.

The purpose of the experiments has been to discover the effects of soil, climate and manure on the yield and quality of the grain. They have been carried out under the Research Scheme of the Institute of Brewing, of the Barley Committee of which the writer is chairman; the arrangement has the great advantage that the produce from each plot is examined in full detail by expert maltsters and brewers.

The first series of experiments, carried out not only at Rothamsted, but on some 15 good barley growing farms in different parts of the country, led to the following conclusions:—

(1) Soil and season are the main factors determining yield and quality in barley. Conditions increasing the quantity per acre of non-nitrogenous material (presumably starch) in the grain, without correspondingly increasing the

amount of nitrogen, appear also to be conditions making for quality.

(2) Sulphate of ammonia in small quantities (1 cwt. per acre) increased the total number of tillers and the number bearing grain; it also increased the yield of grain by about 5 bushels per acre in all the seasons 1922-26, the effect being but little influenced by season. On the average it slightly raised the percentage of nitrogen in the grain, but insufficiently to affect the buyers' valuation. At Rothamsted, however, it usually lowered the nitrogen percentage.

The Institute of Brewing is going further into the question whether the slight change is of any significance in malting, and for this purpose 30 quarter samples of each experimental lot are being obtained this year.

(3) Larger quantities of nitrogenous manure may raise the percentage of nitrogen in the grain so much as to be perceptible by the buyer; in consequence the valuation falls.

(4) Superphosphate also increased the number of tillers, but at most centres it had little effect on yield, except in 1926, and no recognizable effect on quality or on percentage of nitrogen in the grain. On loams in the Eastern Counties, however, it increased the yield and decreased the percentage of nitrogen in the grain.

(5) Sulphate of potash caused little or no increase in yields indeed at one centre there was a depression. It slightly lowered the percentage of nitrogen in the grain but had no effect on the weight of 1,000 corns or on valuation.

The smallness of the effect of fertilizers on the barley grain as compared with the effects of season is shown by the figures at the top of p. 609, being the averages for all our results at Rothamsted and the outside centres. The figures for phosphatic and potassic fertilizers are very similar and show only slight differences.

Effect of Chlorides (also called Muriates) in Fertilizers.—Previous experiments at Rothamsted have show that other substances besides the well-known nitrogen, phosphate, potassium and calcium (lime) have actions on the plant for good or for bad, and of these the chlorine in chlorides is important to farmers because two fertilizers, muriate of potash and muriate of ammonia, contain it in quantity.

NITROGENOUS FERTILIZER.

	1,000 corn weight grammes		Nitrogen in dry matter per cent.		Malt extract on 448 lb. barley		Colour of extract	
	No Nitrogen	Complete	No Nitrogen	Complete	No Nitrogen	Complete	No Nitrogen	Complete
1922 ..	41·8	41·4	1·702	1·767	97·1	97·1	5·5	5·5
1923 ..	40·4	40·4	1·617	1·629	99·8	100·5	5·1	5·2
1924 ..	39·5	39·1	1·434	1·414	97·0	97·5	6·2	6·1
1925 ..	40·0	40·0	1·567	1·649	95·9	95·2	9·7	9·7
Mean ..	40·3	40·1	1·580	1·614	97·5	97·6	6·6	6·6

This chlorine is not a plant food, but it influences some of the changes taking place in the plant. One of the most valuable effects is that of muriate of ammonia on the barley grain. This fertilizer, in some way not at present understood, seems to increase the number of grains per acre attaining the size of head corn. An estimate is obtained by comparing the weight of barley per acre with that of 1,000 corns, and the figures are :—

MILLIONS OF GRAINS PER ACRE.

	No nitrogen	Sulphate of ammonia	Muriate of ammonia	Excess of muriate over sulphate
1922	17·1	18·9	19·8	0·9
1923	10·5	17·3	18·9	1·6
1924	12·0	16·7	17·0	0·3
1925	12·3	15·1	16·5	1·4

The increased number is obtained even in 1922 and 1924, when there was little or no difference in the weight of the crop. There are two possible explanations. The muriate may cause more tillering and consequently a larger number of heads capable of bearing seed, or it may cause a larger number of the florets to become fertile and filled out with seed ; in no head of barley are all the florets fertile. The indications are in favour of the latter explanation. The higher number of grains generally means a higher yield per acre, but not always : the grains may be lighter in weight, in which case the yield is not necessarily increased. The weights of 1,000 corns for the past four years have been, in grammes :—

	1922	1923	1924	1925	1926
No nitrogen	41·5	41·3	42·2	39·2	38·4
Sulphate of ammonia ..	41·7	43·2	42·4	39·6	38·8
Muriate of ammonia ..	40·3	41·8	42·4	40·7	36·8
Original seed ..	44·8				

The yields in bushels per acre have been :—

	1922	1923	1924	1925
No nitrogen	28·2	19·5	20·4	26·0
Sulphate of ammonia ..	32·6	32·8	27·7	32·25
Muriate of ammonia ..	32·5	35·7	28·0	35·0

Now this extra number of grains is obtained without corresponding increases in leaf or straw. The total produce per acre is almost exactly the same for sulphate as for muriate, as shown by the following results for 1925 :—

	Total produce: straw, chaff, cavings, etc., lb. per acre	Yield of grain		No. of grains, millions per acre	Nitrogen per cent. in grain
		lb.	Measured bushels		
No nitrogen	2775	1300	26·0	12·3	1·597
Sulphate of ammonia	3926	1813	32·35	15·1	1·585
Muriate of ammonia	3932	1829	35·0	16·5	1·552

At Rothamsted, muriate of ammonia has always given better money returns per acre for the barley crop than sulphate of ammonia, because when the yield was increased the valuation was not lowered, and when the yield was no higher the valuation was raised. The percentage of nitrogen in the grain is, in each of the five years, less than when sulphate of ammonia is used, and buyers commonly prefer a sample with low nitrogen content, other things being equal.

The percentages are shown by the following figures :—

PER CENT. OF NITROGEN IN GRAIN, DRY MATTER.

	1922	1923	1924	1925	1926
No nitrogen	1·58	1·648	1·611	1·597	1·599
Sulphate of ammonia ..	1·647	1·544	1·517	1·585	1·711
Muriate of ammonia ..	1·602	1·485	1·495	1·552	1·684
In original seed ..	1·472				

It is rare in agricultural experiments to find a rule holding for five consecutive years without a break.

It will be observed that at Rothamsted both the sulphate and muriate of ammonia reduced the percentage of nitrogen in the grain in each of the three years 1923, 1924 and 1925 ; this is different from the mean result already recorded for the whole of the experiments, all of which, except at Rothamsted, are made on lighter soils, while the Rothamsted soil is heavy. The result suggests that, on our heavy soil, the nitrogen so much stimulates the growth of the young plant that it starts early on its career of leaf growth and assimilation, and this results in the making of much more starch.

Late dressings, both of sulphate and muriate of ammonia, had the opposite effect, and increased the amount of nitrogen in the grain. It is only when the nitrogen is applied with the seed that the above beneficial effects were obtained.

Effect of Chlorides (i.e., *Muriates*) *on Root Crops and Potatoes.*—Analysis showed that, under certain conditions, muriate of ammonia gave more dry matter per acre in the roots of mangolds and the tubers of potatoes, and more sugar in sugar beet, than did the sulphate. Further work is in hand to discover how far the result is general and to what it is due. Apparently these results are all linked up with the field observation that the leaves turn yellow more rapidly on the muriate plots than on the sulphate plots, all confirming the view that the chlorine hastens the transfer of material from the leaf to the seed, root or tuber, and so closes down vegetative growth. The first of these actions, the hastening of translocation, is an advantage to the plant; the cessation of vegetative growth may not be. The net result is that the action of a chloride is advantageous wherever growth is in any case closed down by climate or other factors, as happens with cereals and with potatoes grown in cool climates, as at the Edinburgh farm in 1925. But it is disadvantageous if growth would otherwise have continued, as usually happens with potatoes and mangolds in England.

If this generalization turns out to be correct, it will indicate a useful field of fertilizer action for ammonium chloride. The chlorine ion is not a nutrient in the sense of being, like nitrogen, an ultimate constituent of the plant substance; it exerts rather some special directive or controlling effects on the movement of substances in the plant. Three important applications are indicated. There is the possibility of improving the malting quality of barley, while the increased percentage of sugar in sugar beet and of dry matter in mangolds, if found to be general, would be of great agricultural value.

Muriate must, however, be carefully used; when the ammonium chloride was applied late it injured the quality of the barley as already stated, while chlorides, applied to potatoes in quantities of more than 1 or 2 cwt. per acre, depressed the yields. Kainit is an example; it is made up of chlorides and, in our experiments, always gives a lower yield than the sulphate or the muriate of potash. The results at Rothamsted were as given at the top of the next page.

	Potatoes, Tons per Acre.	
	Farmyard manure	No farmyard manure
No potash	8·36	4·95
Sulphate of potash	9·22	8·25
Muriate of potash	9·24	8·39
Low-grade potash salts	8·73	7·89

Even more marked depressions of yield occur when muriate of ammonia is used along with muriate of potash, and especially with kainit; this is shown by the following experiment made by Mr. R. W. Wheldon at three centres in Durham :—

Chlorine lb. per acre	Potassic salt	Ammonium salt	Yield of potatoes		
			Red House	Seaham Hall	Bunker Hill
None ..	Sulphate	Sulphate	100	100	100
80 ..	Sulphate	Muriate	96	98	93
120 ..	Muriate	Sulphate	91	92	87
200 ..	Muriate	Muriate	87	92	85
400 ..	Kainit	Sulphate	77	87	81
520 ..	Kainit	Muriate	77	85	69

Here the effect of the chlorine is consistently harmful; but at many centres the results are as obtained at Rothamsted, where the muriate of potash is practically as good in point of yield as the sulphate, no harmful effect being produced. The quality, however, sometimes suffers, and wherever this is important to the farmer he should use the sulphate rather than the muriate.

* * * * * *

THE POPPLETON (YORKS) BEET SUGAR FACTORY: A DESCRIPTION OF THE FACTORY PROCESS.

AT the close of the 1925-26 manufacturing campaign, the Anglo-Scottish Beet Sugar Corporation commenced the building of three further factories (Felstead, Cupar and Poppleton), two of which were constructed to deal with 500 tons of beet per day, whilst the third, *i.e.*, Poppleton, was erected for an initial daily capacity of 1,000 tons. The Poppleton Factory is some two miles from the City of York, and is conveniently situated in relation to the beet-growing districts in the area. It draws its water supply from the River Ouse. Interesting features have been embodied in its construction, the principal difference, compared with the older type of factory, being in the method employed for diffusion.

Erected in the summer of 1926, the Poppleton factory sliced its first beet on October 20, 1926. From that date until January 20, 1927, over 7,000 tons of white sugar had been extracted from 53,233 tons of beet.

The beets arrive by road and rail, are weighed and tested for sugar content and tare in the usual way. The beets are conveyed into the factory by water power, being picked up from the flume by a large beet wheel and dropped into a device known as the beet washer, where revolving paddles complete the removal of adhering dirt.

Washing of Beets.—The beets leave the washer practically free of dirt and heavy foreign substances, and then pass over an endless screen, known as the "picking table," where a large percentage of the weeds, leaf-refuse and other small foreign substances fall through the mesh of the screen. At the same time employees watch the beets on their journey from the beet washer to the bucket elevator and pick out any remaining leaves and weeds as well as any beets which have been improperly topped or which are in such a condition as not to be fit for sugar manufacture.

Weighing.—Leaving the picking table, the beets fall into a chute, from which they are picked up by a bucket elevator which conveys them some 60 to 70 ft. to the top floor of the building, where they are discharged into an automatic scale. This scale is so constructed as to receive a definite weight—500 kg.—of roots, automatically fill and discharge, and, at the same time, record the weighings.

The heavy work to which the beet scale is subject in dealing with the large quantity of beets which passes through the factory daily renders it necessary to use a check scale in order that any inaccuracy in the working of the automatic scale may be detected and due allowance made therefor.

The object of weighing the beets at this stage is to enable the factory manager to ascertain at any hour of the day what quantity of raw material has entered the factory during any stated period, so that by taking into account the percentage of sugar in the raw material and the quantity of ultimate product obtained, it is possible to keep a strict watch on the efficient operation of the process.

Slicing.—As the beets are discharged from the weigher they fall by chutes into two slicing machines which produce the V-shaped shreds of beet known as "cossettes." The cossettes are produced by the action of knives set on revolving discs,

each knife having a sharpened edge of the shape and size required to produce the type and thickness of cossettes which may be desired.

The beets have now been converted into a form suitable for the first stage of sugar extraction—that of separating from the other substances in the root the sugar which is contained in the beet cells.

Diffusion.—This separation or extraction is carried out at Poppleton by a modern method known as "continuous diffusion." The diffusers, two in number, consist of long cylindrical metal tubes some 9¼ ft. in diameter and about 82 ft. in length, inclined at an angle of 4 degrees to the horizontal. Each diffuser is divided by partitions into 22 chambers, in each of which a star wheel or paddle is mounted, the object of these wheels being to convey the cossettes by stages from the lower part of the diffuser to the highest chamber, during which time a stream of water flowing in the opposite direction extracts sugar, as also other soluble substances, by a process of osmosis.

The paddles in the individual chambers are mounted on a longitudinal shaft which is geared to a drive shaft outside the apparatus. Fresh water enters the twenty-second chamber of the diffuser and, passing by gravity down the apparatus, gathers an ever-increasing proportion of sugar from the cossettes travelling in the opposite direction. The exhausted pulp is thrown out into a scroll conveyor, by which it eventually reaches the drying plant, and is converted into that convenient and very wholesome stock food known as "dried beet pulp."

Before entering the drier, however, the exhausted cossettes are pressed to reduce the moisture content to about 80 per cent. The water pressed from these cossettes still contains a small amount of sugar in solution, and is therefore returned to the apparatus and re-enters the diffuser at one of the intermediate chambers, thus avoiding a certain loss of sugar.

From the first chamber of the diffuser there is a continuous draw of juice, varying in quantity according to the density and sugar content. In this juice there is in suspension a certain amount of fine pulp and sand, which must be removed before the juice is subjected to the clarifying process. The raw diffusion juice, therefore, passes through a system of pulp catchers and separators and then passes into the measuring tanks. This affords a further opportunity of maintaining a

check, not only on the quantity of sugar passing through the factory, but also on the quality of juice being obtained.

Carbonation.—From the measuring tank, the raw juice passes to the defecation or liming station, where a percentage of slaked lime, varying with the quality of beets being worked, is added to the liquor. The limed juice is then passed to the carbonation tanks, where the action of carbonic acid gas results in the purification of the juice, and the precipitation of the lime with the impurities entangled with it. This precipitate is then removed by passing the juice under pressure through filter presses of the plate and frame type. During the passage of the liquor through the mesh of the filter cloths, the lime mud is deposited in layers on the face of the cloths, whilst the filtered juice passes to the second stage of carbonation, where a second precipitation takes place and a further filtration results in the removal of more lime and impurities.

Sulphitation.—Clarifying the juice is completed by a third stage of purification, where the action of sulphur dioxide gas (SO_2) precipitates any remaining lime and impurities, and a final filtration gives what is known as "purified thin juice." By this time there has been obtained a liquor consisting approximately of 13 parts of dry substance and 87 parts of water.

Evaporation.—The large percentage of water must now be removed by evaporation, and, for this purpose, quadruple-effect evaporators are employed. The thin juice enters the first body and is drawn from body to body by means of the high vacuum maintained in the fourth. The fall in pressure from one body to the next, which results from this process, permits boiling at a low temperature. Boiling of the juice in succeeding bodies is accomplished by means of the vapours given off from the boiling juice in the preceding body. So a gradual fall in the temperature takes place and the juice leaves the fourth body at a density of approximately 60 Brix., after having been concentrated with a comparatively small consumption of steam.

Saturation.—This thick juice is thereafter passed through the "blow-up tank," where sulphur and steam precipitate additional lime compounds, these being finally removed by a last filtration through gravity filters.

Crystallization.—The juice is now ready for crystallization, and is accordingly pumped to the pan-floor and enters the

large tanks which supply the vacuum pans, of which there are five. Each of these pans is capable of boiling some 30,000 pounds of refined sugar, the operation of the pans being a matter of some considerable skill and judgment.

The demands of various markets call for crystals of different sizes, and, in the case of the Poppleton factory, a very fine crystal requires to be produced. During the process of boiling the attendants vary the conditions of temperature, vacuum, etc., according to the progress of the crystal formation and the ultimate results desired.

Centrifugation.—When the boiled mass of sugar and syrup has reached the desired stage, the "massecuite," or "fillmass" as it is called, is dropped from the bottom of the pan into a large vessel known as the " strike mixer," which feeds the centrifugal machines.

The centrifugal machine consists of a drum or basket revolving on a perpendicular shaft, having an outlet at the bottom, and a periphery of finely perforated brass screen. The action of centrifuging or spinning the sugar consists in admitting a certain quantity of " fillmass " from the strike mixer, and then increasing the speed until the centrifugal basket is spinning at some 900 to 1,000 revolutions per minute, each machine being driven by an independent motor.

As the mass of sugar and syrup falls into the middle of the basket, centrifugal action causes the product to be thrown to the sides of the container, where the syrup is able to pass through the minute holes of the brass screen. The sugar crystals are unable to pass through and therefore remain as a lining on the inside of the basket.

During the time that the sugar is revolving in the centrifugal machine it is washed, first with wash syrup and then with fresh water. When the machine is stopped, a thick lining of white sugar, in a more or less hot and moist condition, adheres to the inside of the basket. The syrup which has passed through the holes of the screen is run off into tanks, and, according to quality, is re-introduced into the process at appropriate stages.

A bell or outlet gate in the bottom of the centrifugal machine is then lifted and the " lining " of sugar is discharged by scraping it off the sides of the basket with wooden paddles. This moist white sugar is then conveyed by a travelling band underneath the machine to a hopper, where it is picked up

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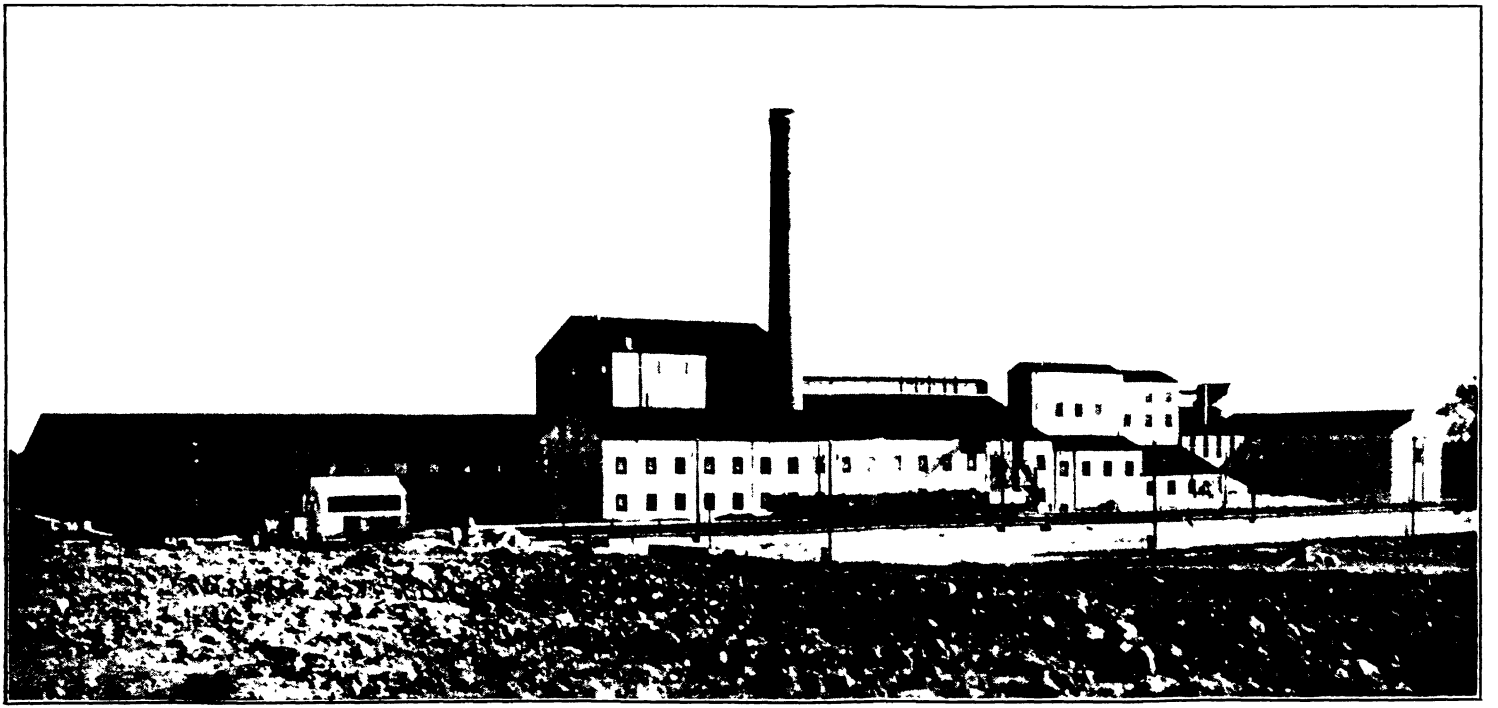
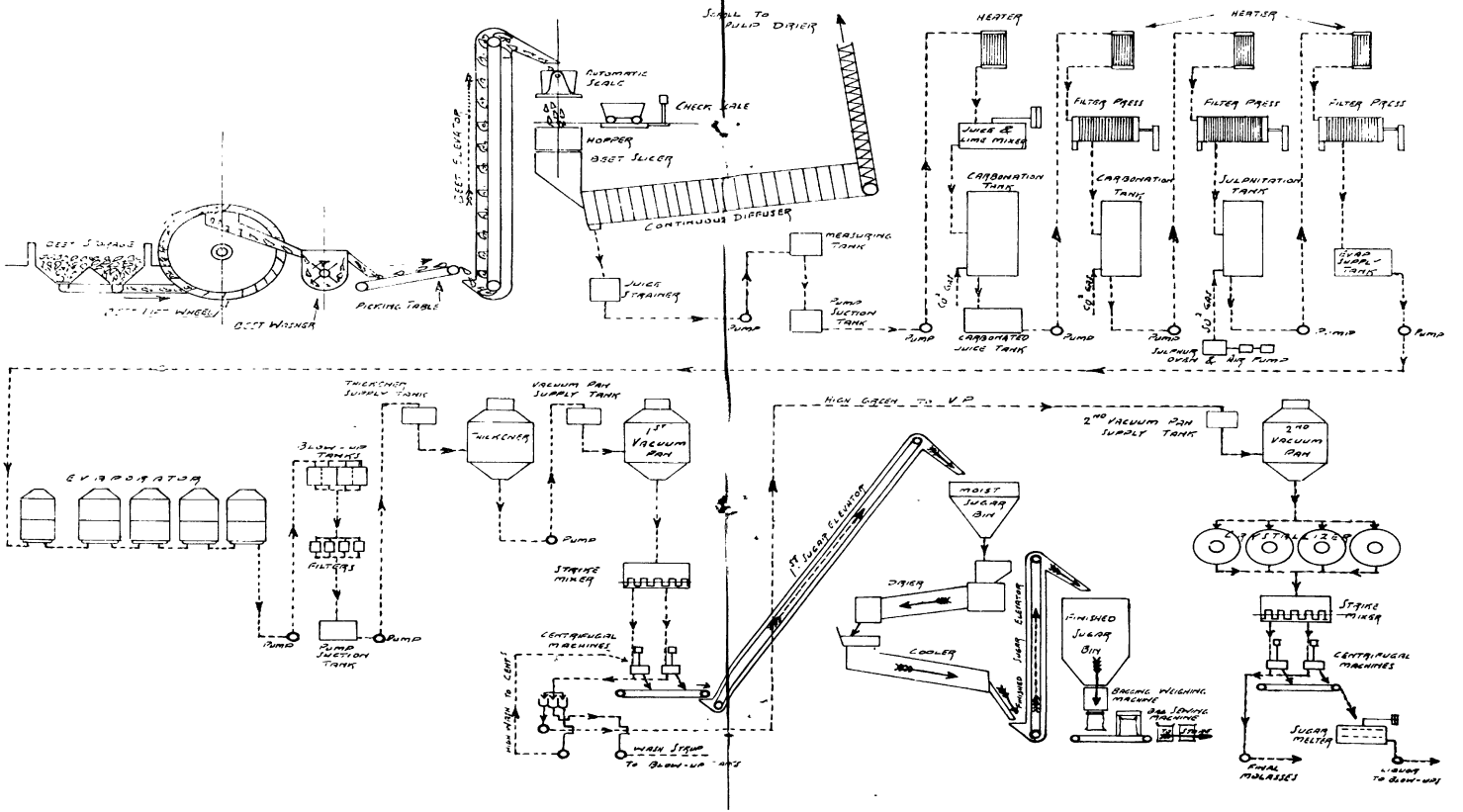


The Poppleton (Yorks) Beet Sugar Factory.

POPPLETON FACTORY – FLOW SHEET.



by a bucket elevator and conveyed to the drier, where it is subjected in a rotating drum to a draught of hot air. During this process the sugar naturally becomes hot. It is therefore passed from the drier or granulator to a drum of similar construction where the action of a draught of cold air reduces the temperature. The sugar then passes along "shakers" which remove the lumps. The lumps return to process for remelting, and the granulated sugar is deposited into the finished sugar bins.

Weighing and Sacking of Sugar.—The sugar is now ready for packing, and is weighed and sacked automatically, the filled sacks being sewn up by a rapidly operating sewing machine. The sacks then pass into store and are ready for dispatch to buyers.

During the whole time, from the entry of the beets into the factory to the final storage of the finished sugar, there is no interruption of the process, neither is the product at any stage touched by hand.

Further Details of the Factory Installation and Working.—In addition to the machinery and equipment directly employed in the various processes, there is a considerable accessory plant for the production of steam, power, lighting, etc.

The steam requirements of the factory are furnished by four Babcock & Wilcox high-pressure boilers and ten Lancashire low-pressure boilers, whilst lighting and power are produced by a modern generating plant consisting of two Weir turbines connected with generators built by the English Electric Company and capable of a load of 1,200 KVA.

The lime and carbonic acid gas used for the purification of the extracted juice are furnished by two vertical lime kilns.

The pressed pulp is dried in two large drum driers manufactured by Messrs. Duncan Stewart & Co., Ltd., of Glasgow; 3,526 tons of this valuable material was produced by the Poppleton factory during the 1926-7 campaign.

In the production of sugar and pulp at this factory during the last campaign, nearly 14,000 tons of coal, 4,500 tons of limestone, over 560 tons of coke, and large quantities of sugar bags, pulp bags, filter cloth, sodium carbonate, sodium hydroxide, sulphur and many other supplies were used. There has thus been created a very considerable volume of new traffic on the lines of the railway companies concerned.

For the 1927-8 campaign, over 11,000 acres of beet are under cultivation for the Poppleton factory, and there is every prospect, in this area, that both tonnage per acre and sugar content will show a marked improvement on the results of last year.

HERBAGE SEED PRODUCTION IN NEW ZEALAND :

V.—SPECIES OF LESSER IMPORTANCE AND GENERAL CONCLUSIONS AS AFFECTING THE BRITISH FARMER

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IN this concluding article it is proposed to give brief particulars about Chewing's fescue, brown top (*Agrostis vulgaris*) and the bird's-foot trefoils, and, finally, to draw certain broad conclusions from the evidence brought forward in the series as a whole, affecting the attitude which it might be desirable for the British farmer to cultivate in relation to the whole question of the production of herbage seeds.

Chewing's Fescue.—For a number of years this species has been fairly extensively harvested for seed in New Zealand. Since 1914, the area devoted to seed production has varied from about 3,000 to 6,000 acres. In 1924-25, the total output amounted to 560 tons—most of this being exported to the United States of America and Canada for lawn and golf-course purposes, the seed also being used to some extent for similar purposes in Europe. The great bulk of the seed is produced in the Mossburn district of Southland, the yield varying from about 200 to 350 lb. per acre.

Chewing's fescue has been classified by Bruce Levy* as a species proper to land of the lower and lowest fertility classes ; on such habitats it grows in remarkably pure association, and consequently the seed crops are often practically free from weed seeds of all kinds.

The production of seed in the Mossburn district constitutes the primary feature of the farming practice. The soil is poor and excessively stony, and will not long carry rye-grass and clover. The usual procedure is to sow Chewing's fescue with perennial rye-grass and red clover, which provides a two-years' pasturage and then leaves the fescue in almost sole possession. A seed crop of fescue is taken in the third year, when the ley is alternately grazed and harvested for seed for two to four subsequent years.

At this stage the turf becomes sod-bound and unproductive. Rejuvenation is then frequently effected by ploughing in

* *See* Levy, E. Bruce : " The Grasslands of New Zealand : Preliminary Ecological Classification of Species," *New Zealand Journ. Agric.*, Vol. XXX, No. 6, June, 1925.

narrow furrows. The fescue makes surprisingly vigorous growth in the furrows, and after a harrowing the following spring gives a heavy crop of seed. A further seed crop may be taken the second year after this rejuvenation. The paddock will then be reploughed and sown with a crop of turnips; and this is followed again by sowing a simple mixture including about 4 lb. of Chewing's fescue. This constitutes the type of rotation practised in the Mossburn district, and affords an interesting example of a system of farming based on seed production. The crop is cut with the self-binder and thrashed out of stook, usually standing in the field for not less than two weeks.

Chewing's fescue is one of those species of which the germination is prone to fall during ocean transit and prolonged storage. This characteristic is now under detailed study in New Zealand, with the result that it has been possible to make definite recommendations to the growers as to improved practices relative to the harvesting of the seed crop.*

Trials at Aberystwyth have shown that, from an agricultural point of view, Chewing's fescue is altogether more productive than the ordinary hard fescue of commerce, but it is not as winter green or as high-yielding as many of the indigenous (British) strains of red fescue under study. In common with the generality of fine-leaved fescues, Chewing's fescue in a mixed sward is not particularly palatable to stock, and only exceptionally can be regarded as a desirable ingredient in seeds mixtures for use in this country.

Brown Top (Agrostis Vulgaris).—Since the war there has been a ready demand for the seed of this species in the United States for lawn and putting-green purposes. The seed is chiefly harvested from the northern gum lands of Auckland, and the annual production now amounts to upwards of 30 tons. Bruce Levy has classified brown top as a species not proper to the lands of lowest fertility, but chiefly to those of moderately low and low fertility, and in connexion with his investigations on the formation of grassland in relation to habitat conditions, considers that a case can be made for the inclusion of brown top in mixtures for some of the low fertility conditions, so that this is a species for which there is likely to be a certain agricultural demand in the Dominion over and above the

* For more detailed particulars as to seed production of Chewing's fescue and as to conditions influencing the viability and vitality of the seed, *see* Foy, Nelson R.: "Chewing's Fescue," *New Zealand Journ. Agric.*, Vol. XXXI, No. 6, December, 1925.

normal export for lawn purposes. Seed production turns on the fact that land of the lowest fertility class, dominated by *Danthonia semiannularis*, has by top dressing with superphosphate been improved up to the standard of brown top, which has now largely taken possession of such improved areas. The usual pre-treatment to obtaining a seed crop is either to disc heavily such grasslands or to plough into shallow furrows as is adopted with Chewing's fescue.

After such treatment, brown top makes rapid growth and throws up an abundance of flowering stalks. The paddocks are shut up in September and harvested in February. The stand is treated as if it were a normal hay crop, but is handled as little as possible ; the produce is drawn by sweepers to the stack and later thrashed from the stack. A rejuvenated field may yield as much as 200 lb. of seed per acre.

The Bird's-Foot Trefoils (*Lotus* spp.).—In New Zealand, two species of bird's-foot trefoil are of very considerable value, particularly on the heavier lands. These are the annual *Lotus hispidus* and the perennial *Lotus major*, and there is now a considerable local demand for the seed of each species, both being harvested to an increasing extent on the northern gum lands.

The Agricultural Usefulness of Lotus Major.—It is not probable that *Lotus hispidus* has any potential usefulness in this country, but the evidence coming under the present writer's notice in both New Zealand and Tasmania leads him to believe that *Lotus major* has a very decided potential value as a herbage seed for special purposes in Britain. It has been used with great success on marsh land and on heavy land subjected to high annual rainfall in the two countries above mentioned, both when sown on existing vegetation and on marsh and swamp land that has been partially drained and ploughed. It has the ability of mingling well with rushes and other coarse herbs, and thus encourages stock in their eagerness for the *Lotus* to graze the former plants to some extent. By its straggling growth, the *Lotus* tends to prevent closely grazed marshy swards becoming too open, a condition very favourable to the spread of rushes, and is thus, under proper management, an important ingredient in the sward unfavourable to rush domination. When *Lotus major* is itself a dominant element in the herbage, it is freely grazed by stock, and they appear to thrive exceedingly well on a ration consisting predominantly of this species.

Experiments are now being initiated at Aberystwyth to test this species under very similar conditions to those in which it has proved so successful in the other hemisphere, and if at all comparable results are obtained it will be fortunate for the British farmer that stocks of seed are likely to become available. At present the seed is both expensive and difficult to obtain in quantity.

Seed Production.—The methods of seed production adopted are in effect the same for both *Lotus hispidus* and *L. major*, and are simplicity itself. Seed production follows after that of brown top on the same fields. Such a sward, when it has commenced to run out, will be heavily top-dressed and heavily disced, following which a great mat of self-established *Lotus* will come into evidence. Experience and local knowledge readily indicate the condition of swards most favourable to the production of *Lotus* seed.

Another method is to plough or to disc sufficiently heavily and to sow a crop of oats, when *Lotus* will appear in profusion in the stubble. The fields would be shut up in October and the harvest taken in January. As with brown top, the stand is treated rather as a hay than a seed crop. It is cut with the ordinary reaper, left to lie out for only a few days and then swept to the stack, and is thrashed after about six weeks in stack. An ordinary mill thrashes effectually, a clover huller not being necessary. The seed sheds freely and, consequently, the crop is handled as little as possible.

In the main, *Lotus major* dominates the heavier, wetter fields, and *L. hispidus* those of a relatively lighter nature; in practice, however, the seed as harvested generally represents both species, the one or other being very much the more abundant off any particular field.

Grassland Rejuvenation.—The methods adopted relative to the production of seed of the bird's-foot trefoils, brown top and Chewing's fescue are of interest as showing the effects that can be produced by drastic methods of mechanical treatment of grassland accompanied by top dressing. These treatments, of course, favour the abundant germination of such seed as is in the ground, while the cultivations also favour the more rapid growth of the plants left *in situ*. Drastic rejuvenation has been tested but little in this country, since the mechanical treatments adopted have seldom been drastic in the sense used in connexion with the methods of seed production described above. It would seem probable that white

clover seed production, no less than *Lotus* seed production, could be assisted by a well-conceived if drastic rejuvenation of swards by mechanical means. These New Zealand practices therefore deserve the attention equally of those concerned with the improvement of grassland and of those interested in the question of the production of herbage seeds in this country.

General Conclusions as Affecting the British Farmer.—The influence of seed production on the agricultural development of New Zealand is a matter which should not be overlooked by the farmers of this country at a time when any means of adding to the cash earning resources of the farm so emphatically need to be explored.

Seed production has had a definitely pioneering influence in New Zealand. It is probably not too much to say that the clearing of the bush in the Akaroa district has been effected almost entirely by the earning power of cocksfoot seed, and thus we now have in that district a thriving dairy industry on land where the production of cocksfoot seed was the original stimulus for clearing, and where consequently a cash commodity was produced almost immediately. Chewing's fescue, equally, has been responsible for making profitable farming possible on land that, but for the seed crop, would have the poorest prospect of earning power.

To-day, brown top and the bird's-foot trefoils appear likely to become very important factors in the successful opening up of the heavy northern gum lands—the profitable harvesting of the seed of these species making just all the difference to the balance sheet of those farmers who have taken the matter up, and constituting an important transitional stage towards the final improvement of these areas to the standard rather of white clover and of rye-grass than of brown top and the bird's-foot trefoils. In a similar manner, the large cheques received by Marlborough farmers for lucerne seed is reacting on the farming productivity of that district, has undoubtedly given a stimulus to the more abundant use of superphosphate, and has generally operated in the direction of higher and better farming.

The fat lamb industry in the South Island, moreover, owes not a little to the fact that it fits in admirably with the production of seed of rye-grass and red clover, these supplementary sources of revenue, like all supplementary production in farm practice, reacting decisively on the profitableness of the enterprise as a whole.

As emphasized in a previous article, it is perfectly true, speaking generally, that the climate of New Zealand is more favourable to seed production than that of this country. As a set-off to the effect of climate, it must, however, be realized that the agricultural usefulness of a particular parcel of seed is not only influenced by the quality of the seed as such, but to a very large extent also by the strain which that parcel represents. This is on all hands appreciated in the case of wild white clover, and is every day more fully realized in respect of red clover, and particularly of the late-flowering strains—the home-produced strains being far more productive and persistent than the foreign. The results recently obtained with perennial rye-grass, cleaned from wild white clover, and thus taken from old swards, are no less suggestive, while the experiments now in progress at Aberystwyth and elsewhere, with strains of indigenous cocksfoot, timothy and other grasses are equally informing. The whole trend of recent evidence should, therefore, serve as a stimulus to the British farmer to approach self support in the matter of his herbage seeds.

It is evident, however, that specialization is needed—that strain must be put in the forefront, and that methods of harvesting and handling must be closely studied in order to counteract, as far as may be possible, the effects of adverse weather conditions. Herbage seed production has the great merit that it is always supplementary; consequently if the crop fails the sward remains and has its independent use.

There would seem to be three main directions in which the British farmer could extend the scope of his activities in this direction: (1) Growing considerably more late-flowering red clover, each farmer always concentrating on a well-authenticated strain and never on any account "once growing" a foreign strain; (2) by growing "once-grown" wild white clover, care always being taken to sow the seed-producing leys with "old sward" white from a well-authenticated source; (3) by, to a greater extent, harvesting seed from the very best of the old swards in the country. It is possible that by the adoption of such a measure the farmer would, to some extent, be helped over the difficulties in which he now finds himself. There is no reason to suppose that the occasional "putting up" to seed of a fatting pasture, if followed by manuring and a long term of heavy grazing, would necessarily seriously harm that pasture; a modification in subsequent management can always be made to counterbalance an occasional departure

from normal practice. Such fields should not be put up for seed for too long a period—heavy crops of seed not being looked for. The proved value of wild white clover and of indigenous strains of rye-grass, cocksfoot and other species does seem to indicate, however, that the " stripping " of high-grade pastures on the basis of a long rotation carried over the whole of the grass farm does perhaps afford to our graziers a possible means of acquiring supplementary revenue from their holdings.

In this connexion it is much to be desired that arrangements should be made to hold a demonstration in this country of some of the leading makes of " strippers," largely used in the Dominions ; and that exhaustive experiments should be undertaken to estimate the influence of taking a periodic seed crop on the subsequent behaviour of the pasture, and the best means of counterbalancing any evil effects that may be shown to result.

In conclusion, it is perhaps appropriate to remark that the influence of the plant breeder will soon be felt—economically felt—in relation to herbage plants. It will be for the British farmer to ask himself whether he desires, despite the limitations of the climate under which he necessarily operates, to take any part in the " growing on " of these pedigree strains under proper supervision for the purpose of making available adequate supplies of such as eventually prove to be of the highest value and importance.

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THE EFFECT OF IRRADIATION AND COD LIVER OIL UPON POULTRY

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THE results of a large amount of research work have already been published concerning the value of cod-liver oil and of ultra-violet irradiation for poultry. Some of this work indicates that these factors have, under experimental conditions at least, a beneficial influence.* It seemed desirable, therefore, to carry out further tests to determine whether such treatment had any practical value for hens kept in the winter months with free access to open air, sunlight, green food and grass ; and experiments were carried out at the Berks and Bucks Joint

*Hart, Steenbock and others. *Journal of Biological Chemistry*, 1925, 65, 579.

Sanatorium, Peppard Common, by permission of the Committee and Dr. Carling, the Medical Superintendent. A poultry farm is run at this sanatorium, producing some 36,000 eggs a year.

Arrangements of the Experiments.—The procedure adopted in these experiments was laid down by Prof. Leonard Hill and Mr. T. A. Webster, of the National Institute for Medical Research, who inspected the pens and all the arrangements that had been made before the experiments commenced, and also at intervals during their progress. Six pens were used, each containing six Rhode Island Red hens in their second laying season, together with a male bird. All these birds had been trap-nested in their pullet year and had yielded between 170 and 190 eggs each. The birds were carefully picked from the main flock, every effort being made to secure birds as much alike in every particular as possible. Each lot was separately housed, and had access by day to a grass run of about one-eighth of an acre, under fruit trees. The houses were 7 ft. × 6 ft. × 7 ft., and afforded each bird 6 sq. ft. of floor space and 42 cub. ft. of air space. There was a dropping board and perch at the back of each house, a foot of dry litter on the floor, and the nest boxes were raised in order to give full floor space for scratching. There was a window at each end of the house, and the front was boarded half-way up and the remainder wire-netted.

Feeding.—The food given was of good quality, but of a non-forcing character, and consisted of 2 oz. of mixed meal and 2 oz. of corn per bird per day. The soft food consisted of the following, all parts by weight :—

Toppings	5 parts
Sussex ground oats	1 part
Uveco poultry food	1 ,,
Maize meal	1 ,,
Fish meal	½ ,,

The fish meal was discontinued after the first fortnight in order to give a ration of less antirachitic vitamin content.

The corn consisted of equal parts wheat and crushed maize. Greenstuff, chiefly cabbage, was given *ad lib.* No house scraps of any kind were given.

Treatment.—The pens were treated as follows :—

No. 1. Control pen.

No. 2. Treatment as No. 1, but received 5 cc. fresh, untreated cod-liver oil mixed with the soft food. The oil was high-grade Newfoundland product, known to be actively antirachitic.

No. 3. Treatment as No. 1, except that part of the toppings, before being mixed with remainder of meal, was exposed

to the rays of a mercury vapour lamp for 15 minutes at 9 in. distance.

No. 4 received 5 cc. of olive oil containing freshly irradiated cholesterol added to the soft food. The cholesterol was exposed in thin layer for half an hour at a distance of 1 ft. to the rays of a mercury vapour lamp. To each fowl was given 25 mgm. of irradiated cholesterol *per diem*. The irradiation and preparation of the cholesterol was carried out by Mr. T. A. Webster and the National Institute for Medical Research.

No. 5. The birds were exposed for 15 minutes each day to the rays of a mercury vapour lamp.

The lamp used for No. 5 pen and also that for treating the food of No. 3 pen was a 100 volt 5-ampere direct current type. This lamp, after three months' use, faded Webster and Hill's standard acetone-blue solution 5 units of the scale in 1 hour at 9 in. distance; one unit approximately equals twice an erythema-producing dose. It was suspended from the roof of the house in such a manner that it could be raised or lowered as desired.

As soon as the birds went on the perch in the evening, those in No. 5 pens were irradiated for 15 minutes at a distance of from 18 to 24 in. The birds took practically no notice of the light. The control of the lamp was in the hands of the Assistant Medical Officer of the Sanatorium, Dr. Paul Tozer.

Results and Conclusions.—The experiment was carried on for 11 weeks, from January 14 to March 31, 1926. The number of eggs laid by the various pens was as follows:—

No. 1.	Control	259
No. 2.	Cod-liver oil	237
No. 3.	Radiated food	232
No. 4.	Radiated cholesterol	221
No. 5.	Birds irradiated	211

All the eggs laid were up to the 2 oz. standard except six small eggs, containing no yolk, laid by pen No. 5.

A few hens became broody, one each from pens 1, 2 and 4, and two each from pens 3 and 5, but three days in the broody coop were sufficient to cure this. The health of the whole of the birds remained excellent throughout, and no ulceration of the combs or wattles occurred among the birds treated with the lamp. The average daily reading taken with the acetone-blue gauge out of doors at Peppard was ½ for January, 1 for February and nearly 3 for March.

Conclusion.—Poultry farmers who keep their birds under proper healthy, open-air conditions with suitable rations and plenty of greenstuff, will not benefit by feeding cod-liver oil or by irradiating either their fowls or the feed.

STRAWBERRY INVESTIGATIONS AT LONG ASHTON—II*

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Investigations on Varietal Strains in Relation to Vigour and Other Characters.—At the outset, it is essential that some explanation be given of the term "strain" in the sense in which it is used throughout this paper. The term has been adopted here advisedly since it is in general use among growers, but the writers wish to make it perfectly clear that the word is not employed in its true genetical significance. The importance of having a good strain or stock of plants has been recognized by many growers. They regard a good "strain" as a stock of plants which is vigorous, crops well and is true to name; conversely, a bad "strain" as a stock of weak plants which bears inferior crops. Notable differences of this sort clearly exist. Owing to the importance attached by the growers themselves to "strain," the real significance of such differences between one set of plants and another requires elucidation. Knowledge on this point may supply the answer to the question as to what extent and by what means, existing poor strains can be improved and maintained at the improved standard. To this end experiments are being carried out at Long Ashton (7, 13). Although the final stage has not yet been reached, reference to this section of the work is advisable here, since certain conclusions which can already be drawn have a direct bearing on some of the practical difficulties of the strawberry grower.

In these investigations, a number of "strains," exhibiting considerable variation in vigour and obtained from different sources, are being grown side by side under exactly the same conditions for a number of generations, in order to ascertain whether eventually the differences in vigour and other features will disappear. Should this happen it would appear probable that differences between one strain and another are due to environmental conditions, *e.g.*, soil, climate and cultivation, and not to genetical differences. At the commencement of the

* The first part of this paper appeared in this JOURNAL for September, 1927, pp. 497-510.

test the difference between the best and the poorest strain as revealed by crop weights was considerable. Interesting facts, referred to below, are the varying degrees to which these strains are affected with " red plant," and the maintenance of this difference over a number of generations.

The effect of the selection of parent and of runner on the yield obtained is being investigated experimentally. Runners have been selected (*a*) by grading and (*b*) by restricting the number made by the parent plant. So far the most outstanding result has been obtained by the restriction of the number of runners formed. In one case an unlimited number of runners were allowed to root, as is often the commercial practice, while in the other only the first three runners were allowed to root. The difference between the resulting crops was very marked.

In a further experiment some parent strawberry plants were selected as exhibiting (*a*) differences in vigour, (*b*) " blindness " or absence of blossom, and (*c*) differences in proportion of blossom to foliage. Runners were layered from these parents and the runners from each parent were kept separate, *i.e.*, pedigree plants were raised. In some cases only a restricted number of runners were allowed to root, whilst in others an unlimited number were taken. It was thus possible to determine whether the restriction of the number of runners formed had any effect, and whether a correlation could be found between the vigour, habit, etc., of the parent plant and its progeny. In this experiment it was found that vigorous parents gave more vigorous progeny than did weaker ones. It need not necessarily be concluded from this that there is any difference in genetical composition between the weak and vigorous parents. The restriction of the number of runners formed had a marked effect, the vigour of the progeny being considerably enhanced. On the other hand no correlation was found between the proportion of blossom to foliage in parent and progeny, or between " blindness " in parent and in progeny. In the latter case " blindness " due to " red plant " is not included. Further experiments are in hand ; these are not yet sufficiently advanced to call for description here.

The points which have come out so far and which have a practical bearing are :—

(1) The correlation between the vigour of parent and progeny.
(2) The effect of the restriction of the number of runners formed.

These two facts point to the value of the selection of both parent and runner. In practice the parents can be selected by

the elimination of the weak and diseased plants, and the runners by grading or by the restriction of the number formed. The latter means has, of course, the greater effect. The number of weak and diseased plants in many commercial stocks is often large ; here selection would be of great value in improving the strains by gradually increasing the proportion of vigorous and healthy plants. In some cases commercial stocks are so bad, the plants being mainly weak and diseased, that time would be saved by obtaining a fresh supply of more vigorous plants and commencing selection on this.

At the present very low prices often paid for strawberry runners it is useless to expect to obtain well selected material. The grower should be prepared to pay a considerably higher price for carefully selected material from which all diseased, weak and " rogue " plants have been eliminated : if he will do so, he will be more than compensated by the greater yield of fruit obtained.

It must be borne in mind, however, that selection by itself will not necessarily improve the yield in all cases. Other factors must be considered, such as the soil and cultural conditions. The best strain may fail under adverse conditions of soil or cultivation. It may, however, be confidently asserted that the selection of parent plants and runners is one of the most important means of increasing or maintaining the yield of fruit.

In conclusion, it is strongly emphasized that successful strawberry growing depends to a great extent on the quality of the " strain", and that efforts to control disease or to improve cultural conditions will not meet with full success unless the " strain " is maintained in a vigorous state.

Strawberry " Diseases."—It has already been shown* that waterlogging, improper cultural treatment and other causes can produce plants of a low order of vigour and abnormal in type. In extreme cases death may result, although no specific organism need necessarily be connected with the " diseased " condition. In the present section certain other forms of strawberry " disease " which have been investigated are considered, *i.e.* :—

(*a*) " Red Plant."
(*b*) Strawberry Aphis.
(*c*) Other types of Abnormal Strawberry Plants.

(*a*) **" Red Plant."**—The disease affecting strawberry plants, known as " red plant," " red leg " or " red leaf," has been

* Part I of this article, this JOURNAL, Sept., 1927, p. 606.

known for a number of years. The symptoms were fully described in 1924 by Ballard and Peren. It was probably first reported in the Tamar Valley and Cheddar Valley districts, and at the present day it is in those districts that the disease still causes most concern. " Red plant " can, however, be found in most strawberry districts and a number of commercial varieties have been affected.

The Symptoms.—A brief description of the symptoms by which " red plant " may be recognized in the spring is given here, since it is at that period of the year that the symptoms are most pronounced. At the outset, it should be stated that an affected plant may bear both healthy and normal crowns, *i.e.*, the whole plant is not always affected. The outstanding symptoms are the absence or extreme weakness of the blossom and the deformity of the young foliage (Figs. 17 and 18). In some cases reduced flower trusses are found, the inflorescence only bearing two or three flowers, parts of which may be abortive. Where there is apparently complete " blindness " the rudiments of an inflorescence can always be found in the axils of some of the leaves (Fig. 20).* The characters of the malformed leaves are as follows: The petiole and lamina† are much reduced in size, the lamina or leaf blade being always small in proportion to the length of the leaf stalk. The leaf stalk tapers, or narrows in width, towards the leaf blade and is much less hairy than that of a healthy plant, sometimes being entirely devoid of hairs. The leaf blade in addition to being much reduced in size is very irregular in shape and often much crumpled. Some varieties, *e.g.*, " Royal Sovereign," exhibit an intense red coloration of these deformed and reduced leaves, but others, *e.g.*, " Sir J. Paxton," do not show this characteristic.

There is no evidence that the " disease " can be attributed to the condition of the root system. All " red plants " which have been examined have had apparently healthy and normal root systems which have been proportionate in size to the amount of shoot growth (Fig. 17).

" Cauliflower " Disease.—Ballard and Peren suggested that there is a correlation between " red plant " and " cauliflower disease," as they found a constant overlapping of symptoms. The symptoms of a typical " cauliflower " plant are as follows: The leaves and flowers are extremely deformed and fasciated,

* In the same Plate the flower truss of a normal plant is figured for comparison Fig.21.

†Petiole = leaf stalk. Lamina = the expanded part of the leaf.

the whole plant when flowers are present resembling a small cauliflower (Fig. 19). Hence the name. A detailed description of the symptoms can be found in the *Journal of Pomology*, vol. iii, p. 142.

The Relation of the Eelworm (Aphelenchus fragariae) to "Red Plant" and "Cauliflower Disease" of Strawberries.—*Aphelenchus fragariae* has for some years been accepted as the causal organism of "Cauliflower Disease" of strawberries, but no infection experiments have ever demonstrated this conclusively and the view is really based upon the presence of this eelworm in the affected parts of the plants. Ballard and Peren found confirmation of their suggestion of the correlation of "Cauliflower Disease" and "Red Plant" by their discovery of *Aphelenchus fragariae* at the growing points of crowns showing "red plant" symptoms, and put forward the view that both these abnormal forms were the result of attack by this eelworm (1).

Further work has confirmed the fact that *A. fragariae* is found in large numbers in "red" and "cauliflower" plants, but one of the present writers also found it in fair numbers in normal plants in the region of the leaf bases (3). An unsuccessful attempt was made to carry out an infection experiment (6). The principal difficulty experienced was in obtaining the plants required for the test free from *Aphelenchus* at the outset. The presence of *A. fragariae* in the soil was investigated at the same time, and the results showed that of the total number of eelworm collected from the soil, only 5 per cent. were *A. fragariae*.

It is therefore evident that *A. fragariae* can be present on the plants without causing disease symptoms. While it does not follow that this fact implies that this species is not the causal organism of these malformations, on the other hand it must not be overlooked that the evidence in support of the view that it is the causal organism is so far purely circumstantial and needs to be supported by positive results from infection experiments before it can be stated with certainty that *Aphenlenchus fragariae* is the cause of either "cauliflower" or "red plant."

Propagation.—The question whether a runner taken from a "red plant" will also itself be a "red plant" is of considerable importance in practice. If this occurs, drastic roguing before attempting to propagate from a stock of plants is extremely desirable.

In one experiment the intensity with which the " disease " occurred in several " strains " for a number of generations was remarkably consistent. In other words, a strain which was most seriously affected in the first generation was also the most badly affected in the second and third. This view, that the disease is carried over from one generation to another when no attempt at roguing is made, is also confirmed by other observations in the field. Some growers at the present time successfully control " red plant " by means of careful roguing, affected plants always being removed as soon as they are recognized. The best time for this operation is during the months of April and May, since the symptoms are at that time most clearly observed, the " red plants," as stated above, being then recognizable by the absence of blossom and by the reduced and deformed leaves, the latter in the case of certain varieties being heavily suffused with a purplish red coloration.

At present it may be said that there is strong circumstantial evidence that the " disease " can be controlled by roguing (12). Some "strains" are more seriously affected than others.

(*b*) **Strawberry Aphis.**—Several species of aphis are found on the strawberry plant, but it is the species known as *Capitophorus fragariae*, Theob., which is found to be causing a definite type of " small leaf " plant.

The aphis was first described by Theobald, in 1912, from specimens sent in from strawberry plants in a greenhouse in Sussex. The insect is small and pale yellowish-green in colour, and is therefore difficult to distinguish on the under-surface of a strawberry leaf which has a similar colour. *C. fragariae* is distinguishable from other species of aphides found on the strawberry by the presence of small knobbed hairs.

Life History.—No egg stage has so far been found. The aphides may be seen all the year round, and reproduce entirely by means of living young. In winter the aphides feed very little, and then principally on the older leaves, reproduction being very slow. In spring the rate of reproduction increases very considerably, and the aphides feed on the young developing leaves (Fig. 25). Winged aphides, also giving rise to living asexual young, are produced throughout the year, but never in very large numbers. There is a tendency for winged forms to be produced more freely in late summer and early autumn.

The Effects of an Attack.—The typical aphis-infested plant has a very characteristic flattened appearance, with small crinkled and cupped leaves, yellowish-green in colour and with yellow edges. The leaf-stalks are short and fleshy. The number

FIG. 18. FIG. 17.

FIG. 19.

FIG. 17.—A typical "red plant" photographed in May, 1926. Note the absence of blossom, and the healthy appearance of the root system.

FIG. 18.—Typical specimens of the "cauliflower" (Type 3).

FIG. 19.—A "red plant" showing reduced and deformed leaves.

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FIG. 20. FIG. 21.

FIG. 20. A "red plant" crown showing an abortive blossom truss. Some leaves have been removed to expose it to view.

FIG. 21. A normally developed flower truss photographed at the same date for comparison with FIG. 20

FIG. 22. Two maiden plants of the variety "Royal Sovereign" potted August, 1925. The plant on the left was infected with Strawberry Aphis, the right-hand plant being kept free from Aphis. The photograph shows the result of three months' infestation under greenhouse conditions.

FIG. 23. A later stage of an aphis-infected plant (Royal Sovereign) illustrating the results of aphis attack.

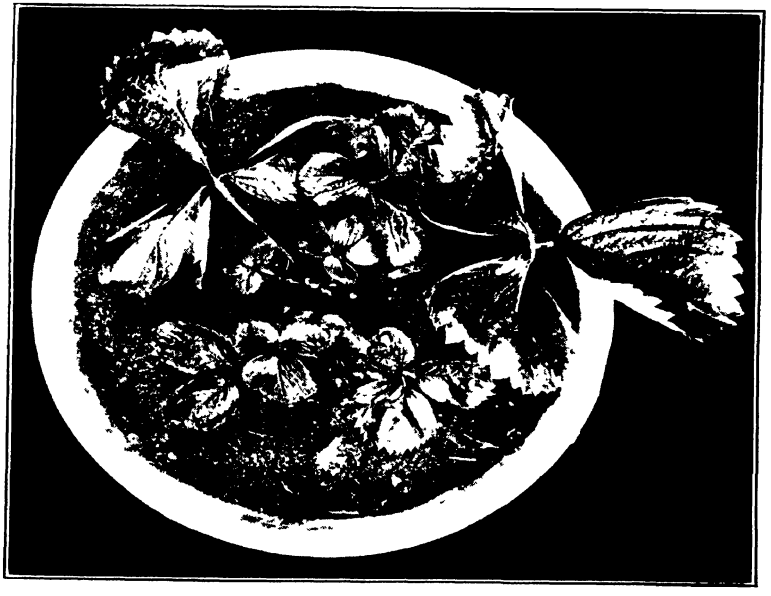

FIG. 24. Showing the effect of dipping an aphis-infected runner in nicotine and soap solution. It will be seen that the foliage formed before dipping is small and deformed, and that foliage formed after dipping is normal in shape, but below normal in size (three youngest leaves).

FIG. 25.—This photograph shows the Strawberry Aphis (*Capitophorus fragariae*) feeding on the developing leaves and petioles of a young strawberry plant.

of crowns is greater than in a healthy plant of the same age (Figs. 22 and 23). The root system is normally in proportion to the shoot growth, and, as the latter is small, the root system is generally inferior. The root system is therefore, by reason of the excessive number of crowns, very inadequate. The size of the root system, as compared with the shoot growth, depends largely on the stage at which the plant becomes infested.

Runners from aphis-infested plants usually become themselves infested at an early stage of development. The aphides walk along the runner stolon and, reaching the runner plants, suck the sap of the young developing leaves. The leaf does not expand normally and a typical yellowish-green cupped and crinkled leaf is produced. Later, the leaf becomes yellow-edged. As soon as the leaf has expanded as much as possible, the aphides walk down the leaf-stalk and attack the next developing leaf. Owing to the continued sucking the successive leaves become smaller and smaller, more crinkled and cupped, with progressive shortening of the leaf-stalks. This severe check to the crown leads to an abnormally early production of lateral crowns by the plant.

In the spring of the second year in the life of the plant the process is repeated. Plants in their second year may have a very large number of crowns. Aphis-infested plants are seldom blind, and, in fact, usually have rather numerous weak blossoms. The fruit is small and frequently deformed.

Variety and Strain in Relation to Attacks of Strawberry Aphis. —From observations made at Long Ashton and in various strawberry districts, it is clear that different varieties vary greatly in their susceptibility to strawberry aphis. Considering varieties without reference to the question of strain in the respective cases, "Madame Kooi," "Laxtonian" and "Royal Sovereign" suffer most severely. "Stirling Castle," "Sir Joseph Paxton" and "President" are a little less susceptible, whilst "Bedford Champion," "MacMahon" and "Ruskin" show distinct resistance. "Marshal Foch," "Sturton Cross," "Lord Overton" and "Aberdeen Standard" exhibit a high degree of resistance. The French variety known as "Tardive de Leopold" has so far shown itself immune, although it was planted amongst "Royal Sovereign" heavily infested with aphis and showing the symptoms of the attack to a marked degree.

The importance of strain in relation to aphis attack cannot be over-estimated. Different strains of a susceptible variety exhibit varying degrees of susceptibility to aphis attack. A

plant of a resistant strain, even if fairly heavily infested with aphis, often remains free from symptoms until after the cropping period, when the symptoms often appear. The effects of aphis are seen sooner and more markedly after cropping when a large amount of fruit is borne. Strain in relation to strawberry aphis would seem to be largely a question of the vigour of the shoot growth. Where the shoot growth is vigorous the developing leaves expand before the aphides have damaged them sufficiently to cause marked deformity. During the fruiting period the shoot growth is slow and the plants "go off" rapidly.

The Control of Strawberry Aphis.—The work, so far as it has already proceeded, appears to justify the following recommendation for the control of the pest.

Only clean runners free from all symptoms of aphis attack should be planted, and such runners should be taken only from healthy plants. Before planting, all runners should be dipped in nicotine made up to the following formula :—

Nicotine (98 per cent.)	½ oz.
Water	10 gal.
Soap	Sufficient to produce a lather, so as to ensure that the solution will wet thoroughly.

The runners may be dipped entirely in the solution, or the "tops" only immersed, in which case any soil round the roots need not be disturbed. The runners need only remain in the solution sufficiently long to ensure thorough wetting. It will be found that dipped runners planted in the autumn will remain free from aphis until the following spring (Fig. 24).

It has already been pointed out that aphis-infested plants, showing the typical symptoms of the attack, do not become normal. Plants must therefore be kept free from aphis, and if the symptoms develop, affected plants should be removed and burned. The remaining plants should be sprayed, as a preventive, with nicotine and soap solution according to the formula recommended for the dipping of runners. As an alternative, plants might be dusted with a good insecticidal powder containing some form of nicotine. Whichever method is adopted, it is essential to ensure that the spray or dust reaches the crowns and the under-surfaces of the leaves. It is particularly important that plants should be free from aphis in the late summer and early autumn, when the new root system is being formed. Spraying or dusting should therefore be carried out immediately after cropping.

(*c*) **Other Types of Abnormal Strawberry Plants.**—So far, in this paper, five types of abnormal strawberry plants, *viz.*,

" miffy," " small-leaf," " red plant," " cauliflower " and small-leaf type of plant due to aphis attack, have been already described. In addition to these, two further types are sometimes found in the field. In the one case the name " sudden wilt " has been provisionally given and the other " patch " is the term commonly applied by growers. The latter is placed tentatively as Type 6 in the classification table given later in this paper.

" *Sudden Wilt.*"—" Sudden wilt " is not of widespread occurrence, but at times quite serious cases have been noted in which a fairly high percentage of plants in a field were affected.

Plants affected in this way exhibit the following well-defined symptoms: The foliage wilts rapidly, the outer leaves lose their erect position and droop until they are lying on the surface of the soil. The younger leaves at the centre of the plant also become flaccid or limp. Plants may be affected at any time from the early summer onwards. When the plant is first affected, before the fruits have completely developed, the latter never reach maturity. In many cases the whole plant dies; in others all the foliage dies, but later a number of small weak lateral crowns are produced, giving rise to a small-leaf type of plant. Up to date certain fungi have been isolated from such plants but no proof has yet been obtained that any one of them causes the trouble. It is possible that certain adverse conditions for the strawberry plant are necessary before these fungi can be parasitic.

" *Patch.*"—" Patch " occurs in most strawberry growing districts. So far it has been most extensively reported in the Tamar Valley and Southampton districts. The name " patch " has been given because, as a rule, affected plants are confined to well-defined areas in the strawberry beds. Such areas gradually enlarge. Isolated plants elsewhere in the fields can, however, be found with identical symptoms. Plants showing typical " patch " symptoms are never less than two years old. A " patch " plant can be recognized by the following characters :—

> The crowns are very numerous, some of them always being dead. The surviving crowns are weak and produce leaves which are distinctly subnormal in size. These leaves are yellowish-green and usually cupped and distorted. The leaf stalks are short in proportion to the size of the leaf blade and are hence very short indeed, the leaf blade being itself much reduced in size. The plant as a whole has a much flattened appearance and consists of a large number of weak and dead crowns. The roothold of the plant is very poor and any new roots which are formed are weak and few in number.

It will be seen from this description that a " patch " plant closely resembles the types produced by (*a*) an aphis attack (Type 5), of (*b*) some damage to the roots or some cause preventing free root development (Type 2). It has in addition a number of dead crowns. Hence, knowing the causes of Types 2 and 5, the view naturally suggests itself that a " patch " plant is a later stage of Types 2 or 5, the only additional symptom being that of dead crowns. Considering first of all the case in which a well-defined area containing a number of plants is affected, the most likely supposition is that the condition of the plants is primarily due to adverse soil conditions within that area, followed in many cases by a general attack of aphis over the whole field, which affects to a greater extent the weakened plants in the " patch " area. Considering next cases in which isolated plants exhibit typical " patch " symptoms, it seems again an advanced stage of Types 2 or 5, with the original cause of weakness of the plant as either root damage, failure to form roots owing to crown exposure, or aphis attack. The writers are of opinion that an investigation of the physical and chemical properties of the soil within " patch " areas is essential before the problem can be fully solved.

Summary.—In Part I of this article the present position of certain aspects of the strawberry growing industry was briefly reviewed. Though there are certain well-defined maladies which account in part for the deplorable decline in strawberry crops yet many causes of failure are still obscure. Some suggestions put forward by growers and by the writers are described, and a general scheme of experimental investigation of certain aspects of strawberry culture is summarized.

In the first instance a careful, detailed study of the life history of a normal plant, from the date of planting through three consecutive seasons, has been made. This study has revealed some important points. The bulk of the root growth has been found to take place mainly in the later summer and autumn. Roots formed during this period are strong main roots arising from between the lower leaf bases. On these roots large numbers of fine feeding roots arise during the spring and these form the essential absorbing organs of the plant during the flowering and cropping season.

The distribution in the soil of the roots of a normal plant has been ascertained and the essentially shallow rooting habit of the strawberry is clearly shown.

Concurrently with the work on the development of the normal plant the influence of such factors as time of planting,

methods of cultivation, and mechanical damage have also been studied.

Experiments at Long Ashton have shown the enormous advantage to be gained by early planting of the runners. The crop obtained in 1926 from "Royal Sovereign" "maidens" planted on August 8, 1925, was almost four times that obtained from a second batch of runners of the same strain planted on September 8, 1925.

Planting methods have been investigated and the deleterious effect of shallow planting is shown to be very marked. The poor vigour of shallow planted runners is due to the fact that normal root development is much restricted.

This same cause underlies the production of weak, small-leaved plants with their crowns in poor contact with the soil. Where hoeing is performed too close to the crowns of the plants, so that either (*a*) soil is scraped away and the young new main roots are unable to reach the soil level before death or damage occurs, or (*b*) roots already established are severed, then a small-leaved weak plant results. The greatest danger from (*a*) occurs immediately after cropping, when the most important phase of new root development commences. Danger from (*b*) is likely to occur in late autumn and spring cultivations. It has been further shown that a slight earthing up of the plants as soon as practicable after cropping increases the chances for root development with consequently an improved, more vigorous plant in the following cropping season.

Poor drainage with consequent water-logging causes death of a considerable portion of the root system, and this again is reflected in the "top" growth, small-leaved weak plants resulting.

Mechanical damage to the main crowns leads to the production of a definite type of abnormal plant frequently described as a "miffy" plant. Accidental or careless hoe damage may account for many such plants. Though the majority of these plants recover, at least one crop is lost as a result of the damage.

Experiments which are being carried out to investigate the causes of the difference between one so-called "strain" of plants and another are described. These experiments have so far revealed the importance of selecting parent plants and runners as a means of raising and maintaining the yield of fruit.

The symptoms by which "red plant," "red leg" or "red leaf" can be recognized in the spring are outlined, the most

useful characteristics being the absence or partial absence of flowers and the reduced and deformed leaves, the latter in the case of certain varieties, *e.g.*, "Royal Sovereign," being intensely suffused with a purplish red pigment. The disease was found in all strawberry growing districts visited, and most commercial varieties have been seen to be affected. The possible importance of the strawberry eelworm as the casual organism of both "red plant" and "cauliflower" is discussed. Some evidence has been obtained that the "disease" is inherited from the parent plant by the runners, and careful "roguing" or elimination of affected parents from the runner bed in the late spring is suggested as a means of control.

A description and the life history of the strawberry aphis are given, and it is shown that an attack of strawberry aphis produces a flat, small-leaved plant, having yellowish-green, yellow-edged leaves with short leaf-stalks. Such a plant has an excessive number of crowns and the root system is often poor. Variety and strain are discussed in relation to the attacks of strawberry aphis. Some varieties and some "strains" have been seen to be more susceptible to attack by the aphis than are others. The dipping of runners, before planting, in nicotine and soap solution, and spraying or dusting the plants if they should subsequently be attacked, are suggested as means of control.

Two other maladies of the strawberry plant, *viz.*, "sudden wilt" and "patch," are described. An explanation to account for the production of "patch" plants is put forward.

In this account of strawberry investigations six definite abnormal types of strawberry plant have been described, and, for the sake of the convenience, a full description of each of these types is appended in tabular form (pp. 640, 641). It has been found that these six types cover all the important strawberry troubles, apart from mildew, leaf spot, and certain minor insect pests with which the strawberry grower in England is concerned. Further, it should be mentioned that this classification after completion was fully discussed with advisory officers from the Southampton, Tamar Valley and Clyde strawberry growing districts, and complete agreement was reached.

Recommendations.—Some of the investigations described in Part I of this article have not yet reached completion, but the writers feel that a point has been reached when certain definite recommendations can be given to strawberry growers.

Some of these suggestions are not new, but since much of the existing unsatisfactory position of strawberry culture is due to not carrying out proved methods it is desirable to point them out here.

(1) Planting should only be carried out on land that is well drained, for bad patches in a field are often due to poor drainage.

(2) Planting should be carried out at the earliest possible date for the particular district, in order that the plants may be well established before the winter.

(3) If the runners are bought it is essential that only the best possible material should be planted. In the course of propagation runners should be obtained only from selected parents, all weaklings, rogues, or diseased plants being removed in the spring at blossoming time. The runner bed should again be rogued carefully for diseased or abnormal plants at the time when the runners are layered. Restriction of the number of runners formed to first runners only is worth consideration. The parent plants should generally be de-blossomed.*

(4) All runners before planting should be dipped in a solution of nicotine and soft soap. During the remainder of the life of the plant spraying or dusting should be carried out as occasion demands in order to keep the plants free from aphis, particular attention being given to this point during the period of new root formation (July to November).

(5) The roots should be disturbed as little as possible at any time. The plantations should be cleaned and cultivated immediately after cropping and every encouragement should be given to root growth at this season, *e.g.*, by maintaining close contact between soil and crown. Slight earthing up of the plants is decidedly advantageous, as it increases the chances of vigorous root production.

(6) To minimize risks of waterlogging of established plants shallow furrows should be made between the rows before winter, especially on the heavier soils, care being taken not to damage the roots.

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* Some experiments to determine the effect of the age of parent on the quality of the runners produced are in progress at Long Ashton.

TYPES OF STRAWBERRY MALADIES
CHARTS

Type	Crown	Lamina						Petiole					New Root Development		
		Lobes	Size	Colour	Margin	Shape	Character	Rel. Length to Lamina	Thickness	Shape	Colour	Flower	Number	Vigour	Cause
I. "Miffy"	Weak, numerous spaced	Variable in number	Small ..	Tendency to red	Coarse	Normal usually	Normal	Long ..	Thin ..	Normal	Red in some varieties	Absent ..	Normal	Normal	Crown damage
II. Small Leaf	Weak, numerous dense	Normal	Small ..	Yellowish green	Normal yellowish edge	Normal	Normal	Short ..	Thick ..	Normal	Yellowish	Weak ..	Normal	Poor ..	Waterlogging. Desiccation, Cultivation damage
III. Cauliflower	Hypertrophied to extreme fasciation	3 to 0 ..	Reduced	Normal to yellow-green	Variable	Variable	Variable	Variable usually long	Thick ..	Tapered	Beetroot red to pale blue-green	Absent or cauliflower	Normal	Poor ..	Aphelenchus(?)
IV. Red Plant	Normal, few spaced	Variable 3 to 0	Reduced	Red ..	Coarse to no teeth	Abnormal variable	Normal to curled	Long ..	Normal	Tapered	Red ..	Reduced or dead and no visible	Normal	Normal	Aphelenchus(?)
V. Resulting from Aphis attack	Weak, numerous dense	Generally 3	Small ..	Yellowish	Coarse	Variable	Cupped-crinkled	Short ..	Thick ..	Normal	Yellowish green	Numerous weak sometime absent	Normal	Poor ..	Strawberry Aphis (Capitophorus fragariae)
VI. Patch	Weak, numerous some dead	3	Small ..	Normal to greenish yellow	Coarse	Variable	Crinkled to normal	Short ..	Thick ..	Normal	Greenish yellow	Numerous or absent	Poor	Poor ..	Probably a later stage of Nos. II or V

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FARM COST ACCOUNTS*

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IN a recent issue of *Punch* the following conversation between a smallholder and a labourer is reported, illustrated by one of Mr. Raven Hill's delightful sketches.

> *Smallholder :* But if you don't keep books, how do you know where you are ?
>
> *Giles :* Ain't got no patience, I ain't, wi' all this nonsense 'bout book-keepin' an' 'counts. If the hens be layin' there bain't nothin' to worry about, an' if they bain't layin' there bain't nothin' to put in the book.

A good deal of sympathy may be expressed for Giles's point of view, without admitting that he was entirely right. The broad fact is that farming presents, from the accounting standpoint, a problem of a rather peculiar kind, for the following reasons : (1) There are certain definite limits set by natural conditions to what can be produced on a farm ; for example, it is no use trying to grow wheat in regions where it will not ripen, or good malting barley on land that will, from its very nature, tend to produce a heavy crop of inferior quality. Again, sheep cannot be kept on land that will be spoiled for cultivation through their treading on it in all weathers. Hence the farmer's choice of alternatives is limited. (2) The yearly profits from farming are influenced to a great extent by yields and by current prices of produce, and these are, in great measure, outside the farmer's personal control. Crops must be sown and stock bought a considerable time before either can be ready for sale ; and it is only in the case of a few products, such as milk and, in more recent times, sugar beet, that a price basis may be fixed before the goods are produced. Even then the yield and the quality are matters of uncertainty and affect the ultimate return in money to the farmer. (3) Farming is, almost of necessity, conducted upon a relatively small scale ; and in saying this, I am thinking, not in terms of the amount of land occupied, but rather of the number of people employed, and of the fact that it is usually necessary to confine the business within such a size that the farmer can keep a personal control over detail. He knows each field, and decides, after thorough inspection and consideration, what ought to be done, having regard to weather

* This article is substantially the text of a recent broadcast address by Mr. King, who has since been appointed Advisory Economist to the Board of Agriculture for Scotland.

conditions and the state of the land and the crops. If he is a smallholder, or a dairy farmer, he may often milk many of the cows himself, and even on the larger holdings, farmers are often their own shepherds. (4) Perhaps the most important point is that it is generally true to say that agricultural products are what are termed "joint products," which means that they are linked together and are mutually dependent upon one another within the scheme of production. Crops must usually be grown in a rotation, and the arable crops and the livestock mutually support and help one another. To these four characteristics of the industry we must add that the farmer is, after all, a practical open-air man, and he is tired in the evening after a day's work and not very inclined to settle down to account keeping.

As a result of all these conditions, farmers are inclined to think that accounts, particularly those accounts which go into details of cost and return, will not help them very much to manage their affairs better. Experience in keeping detailed accounts for a number of farmers has, however, revealed two or three things which it may be important to note. One of these is that, although returns vary very much from year to year, the costs and expenses of the farm do not vary so much; and, after a year or two's experience, it is possible to predict, with a comparatively small percentage of error, the costs of carrying out many of the processes of the farm. Another thing that has been observed is, that when farmers are absorbed, as they necessarily are, in the details of their work, they may not be able to detect those broader tendencies which are operating to make the business more or less profitable. It is, to use the old metaphor, quite easy to lose sight of the wood in looking at the trees. Again, experience of farm account keeping has shown that, if the keeping of cost accounts is approached from the point of view of the costs of the *processes* of farming, rather than from the point of view of the costs of the separate *products*, a good deal of light may be thrown upon the sources of profit and of loss.

Three Things Vital to Efficient Organization.—One may suggest that there are three things which are vital to the really efficient organization of the farm from the farmer's standpoint—from the farmer's standpoint because we are looking at farming through the eyes of the farmer who is doing the job in order to make a living. There are, of course, other viewpoints, but they are not under discussion here. What are, then, these three vital things for successful manage-

ment? (*a*) In the first place there must be a proper balance between the various activities of the farm, that is, the system must fit its environment. If the system is rightly conceived, then each element in the system, the various crops and the livestock, must be given their proper weight. (*b*) Each aspect of the farming should be developed to the maximum profitable limit that is consistent with occupying its proper place in the system. (*c*) There must be no avoidable waste of labour, power or material in any direction.

Putting the matter shortly, there must be the right kinds of crops and stock in the right proportions: the best use must be made of each; and neither time nor material should be wasted. These three things, of course, hang together, but I want to suggest that farm accounts can be organized suitably and simply to show the farmer how far he is achieving all these requirements of sound farming. Practical farmers will no doubt agree, however, that every farmer's problems are not the same. In some cases the question of the proper weight to give to various elements in the farm economy, in order to maintain a proper balance, may be the central problem. For example, on some of the downland farms in Hampshire, Dorset, and the Isle of Wight a really difficult problem, at the moment, is how to maintain a proper balance between sheep and corn, in order to make the farming as profitable as it can be at current prices. Downland farmers may sometimes have been able to make more money by increasing the number of sheep folded on their arable crops than by arranging for a maximum output of corn. To-day, the converse is the case, because the selling prices of sheep are low, and sheep have been bringing a very small return in comparison with corn crops. It is largely a question of the relative selling values of mutton and of wheat or barley, and it seems important for such farmers to know within what ranges of selling values it is better to put the emphasis on the one side or the other within the limits set by the conditions of their farms.

In other cases the conditions and surroundings of the farm may dictate, more or less definitely, the general policy to be followed at current price levels. For example, in areas in the eastern counties where corn will ripen well, but grass and forage crops tend to be poor, the inevitable policy will be to secure as much arable produce as possible for sale, and use cattle or sheep merely or mainly as agents for maintaining the fertility of the land. This is because the price of livestock, imported from abroad, or reared in the west country, is so

low that the eastern counties farmer's costs of growing forage put him out of court. If bullocks or sheep are used merely as machines for converting straw or root crops into fertility, and, in their absence, some other means of keeping the land in good heart would have to be employed, it seems to be important to know what is the cheapest and best way of maintaining the fertility of the land. The question is not what is the cost of fattening a bullock or a sheep in the process, but what is the cheapest way of producing manure.

In more westerly areas, where natural conditions make it easy to grow good grass and forage crops, but where only poor and uncertain yields of corn are obtainable, the main weight in the farming system will necessarily be upon cattle or sheep, and the corn crops will be subsidiary, because they do not ripen well and are grown mainly for feeding to stock. For the milk-producing farmer in the west country there can be no doubt that the keeping of cows on his land is better than trying to grow poor corn crops, and for him the problems are: how to feed his cows most economically; how far to push up his yields of milk in order to make the maximum profit under the conditions prevailing on his farm; how to maintain most economically the required number of cows. If he grows some corn, he will not expect that, in itself, to be a profitable venture, but it may pay him better to grow corn than to buy straw for the stock. That is a question of relative costs. These and other similar questions, accounts can help the farmer to answer. The first thing, however, for a farmer to decide is, What are the problems on my farm about which I feel uncertain? Having asked the question, the cost accountant may help him to find an answer.

Examples.—We may well consider one or two examples. On a certain downland farm, where soil, gradients, rainfall and other physical factors prescribe an arable-sheep policy, it has, in the past few years, been a question how far it pays to concentrate sheep on the land at the expense of corn. Whereas the sales of corn exceeded the outlays directly incurred on the corn crops on the average by about £4 10s. per acre in 1924 and 1925, the excess of sales over the costs of forage and other direct expenses on the sheep were £4 5s. per acre in 1924, and only £2 10s. per acre in 1925. Of course, out of these gross returns, rent, rates, and establishment charges had to be met, and without knowing what these overhead charges amount to you will not be able to calculate how much profit, if any, arises—though that is

scarcely the point. The point is that, whereas every sheep that could be carried was being kept, and more corn might have been grown, the returns, acre for acre, were coming down on sheep and coming down much less on corn. It was worth while for the farmer to measure those changes accurately, but his cost accounts told him still more. They told him that his outlays on corn and sheep had not varied appreciably in the two years, and how much they were, acre for acre; and it became possible to say at what prices, for his average yields of corn, lambs and wool, it would pay to alter a little the balance of cropping in favour of more corn or more forage for sheep, within the limits set by the needs and capacity of his land. Cost accounts cannot, of course, influence the prices of corn and sheep—farmers have got to take some risks—but farmers can rely more upon judgment, and less upon chance, if they are able to measure one side of the problem, the cost side, accurately, even if they are in doubt about the selling prices.

As another illustration, take the experience of a Lincolnshire arable farmer. Last year he had 180 acres under saleable crops—corn, sugar beet, and potatoes. His gross income in excess of direct outlays on these crops ranged from about £2 per acre on barley to over £12 per acre on potatoes, out of which he had to meet his overhead charges. His bullocks failed to meet the outlays directly incurred for forage crops and other expenditure by about £300, which represented the cost of carrying out their part in the farm economy, which was to turn his straw into manure for keeping up the yields of his arable land. He was rather surprised to learn this, and he is trying to reach the same end by other means —having a good water supply, he is experimenting with making manure artificially.

To take a last example. A west-country milk producer's cost accounts could throw some light upon the vexed question whether mangolds should be discarded in favour of concentrated food for milking cows. Some farmers have found this change profitable: in the case under notice the effect of the change was certainly to increase the output of milk, but unfortunately the costs were so far increased at the same time that the margin between costs and selling prices was not big enough to stand it. The right thing to do seems to depend upon the circumstances of the case, and these are reflected in the costs.

So far, my illustrations have been concerned with the

proper organization of the farm and the intensiveness of production. There is the further question of detecting waste. If men are not kept fully employed on jobs that bring a reasonable return from their work, waste is occurring. It is often found that a crop or a new process could be introduced that requires more labour and brings more money back to the farm, without adding to the number of men and horses required, or even increasing the total hours worked by the men. In that event, the extra return is mostly gain because the costs are not increased. If bigger crops could be grown for less than a proportional increase in cost, by giving more or different kinds of artificials, waste is occurring, waste of the productive powers of the soil. If too many horses are being kept; if an old-fashioned implement, expensive to work, is in use; if the cowman, who has not had the opportunity to study the principles of rationing, is giving more food than is necessary to produce the milk; or if the carter is taking each month a sack of oats more than the horses need, "just to make them look well," waste is occurring, and that kind of waste will often run into £100 or £200 a year without the farmer knowing it. None of these things mean dishonesty, they merely mean insufficient control of important detail. The cost accounts will find them out and save money. It is not possible to deal here with the methods of cost accounting, but I hope it has been made clear that it may be worth while to take some little trouble to find out more about the costs of working the farm. The costs are not really difficult to determine, and if based upon sound principles, and limited to what the individual farmer wants to know, they are within the reach of most farmers who can handle figures at all, and who think that a little trouble is worth while. Farmers who are interested to know more about methods, should communicate with their county Agricultural Organizer.

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THE PRODUCTION AND MARKETING OF TABLE POULTRY: REPORT

A REPORT on the Southern Table Poultry Experiments just published deals with experimental work which has been carried out during 1925-6, on part of the South-Eastern Agricultural College Farm at Wye, Kent, under the National Poultry Institute Scheme. The experiments are under the control of a sub-committee which is constituted as follows: Principal R. M. Wilson, B.Sc. (*Chairman*), Messrs. H. Corrie, J. H. Dowden,

A. P. F. Grant, T. Neame and M. W. Slade (nominated by the National Poultry Council); Mr. N. Kenward (nominated by the Ministry of Agriculture and Fisheries); Mr. A. S. Juniper, Mr. E. Hardy and the Hon. W. E. C. James (co-opted by the sub-committee); Mr. P. Hedworth Foulkes, B.Sc. (nominated by the National Poultry Institute Advisory Committee); with Major C. H. Eden representing the Ministry, and Mr. C. T. Stock as Secretary.

Object of the Experiments.—The experiments are designed to furnish data for the information of the poultry industry on the following questions:—

1. The best methods of feeding and marketing, at all times of the year, birds produced as a by-product on commercial egg farms.
2. The economic value for table purposes of the breeds most generally used by commercial egg farmers as compared with the breeds and cross-breeds generally regarded as the best for table use.
3. The amount of weight and value of weight gained, by the various breeds and cross-breeds used in the investigation, in relation to the weight and value of food consumed.

In order to obtain the data required, the Committee decided to attempt a comparison between the breeds most commonly kept by egg farmers and some of the better known table breeds and cross-breeds. They therefore commenced the investigation with breeding pens composed of the following breeds and cross-breeds:—

White Leghorn, White Wyandotte, Rhode Island Red, Light Sussex, Indian Game (male) × Light Sussex (female), Silver Grey Dorking (male) × Light Sussex (female).

The chickens from each breed and cross-breed were divided into four lots and marketed as follows:—

(1) As petits poussins.
(2) "Off the run" or green chickens.
(3) Crate fed.
(4) Crammed.

Records were kept of the amount of food consumed in each of the various pens and fattening crates used in the experiments; all the food fed was weighed and debited to the particular pen, breed or crate, so that a complete record of the food consumed by the birds in any pen was available at any time.

At each killing stage the following data were noted for each breed and cross-breed: (1) Average live weight of cockerels and of pullets (live weight being taken immediately before killing, crop empty); (2) Average dead weight of cockerels and of pullets (dead weight being taken as marketed—plucked, carcass cold, but not "roped" or "drawn"); (3) Total weight of food (dry) consumed by each breed and cross-breed.

From these records the following further data were worked out for each breed and cross-breed : (1) Average weight of food (dry) consumed per bird ; (2) Average cost of food consumed per bird at each of the killing stages ; (3) Average weight of food (dry) consumed per pound of carcass weight at each stage ; (4) Average market value of carcass at each stage ; (5) Average cost per carcass (food only) at each stage.

General Review.—Owing to fluctuations of market prices, which may vary considerably during consecutive days of the week, the actual prices realized cannot be relied upon to serve as an accurate index of the relative quality of table birds marketed on different days. The salesman appointed to receive the produce from the experiments therefore makes a special report on the relative quality of the various breeds and cross-breeds of chickens as received at the market. Relatively small numbers of birds were dealt with during the experiments under review owing to the incidence of disease (bacillary white diarrhœa and coccidiosis), shortage of eggs during the winter months, and insufficiency of broody hens. The sub-committee does not wish to make definite recommendations on the results obtained until the experiments have been concluded, when fuller data will be available ; but the following general remarks on the breeds and cross-breeds used in the experiments may be of interest.

Indian Game (*male*) × *Light Sussex* (*female*).—This cross showed sex linkage as to down colour. The majority of the chickens of this cross had white skins and white legs, some showing a horn colour in the legs. A proportion, however, had yellow legs, and the skin of these yellow-legged birds varied from white to a very deep yellow. The broad, well-fleshed breast of this cross made it an ideal table chicken.

Silver Grey Dorking (*male*) × *Light Sussex* (*female*).—The chickens of this cross had five toes on each foot similar to the Dorking. This fifth toe is usually well developed, but occasionally chickens only showed this fifth toe as a rudimentary growth. The colour of the legs and flesh was white. The long breast and large size of this cross made it an excellent one for table purposes.

Light Sussex.—This breed has the white legs and flesh so much desired by buyers of table poultry. The chickens of this breed were ready growers and attained a large size. They produced a long, well-fleshed breast, and of the pure breeds were probably the most desirable of table fowls.

White Wyandottes.—This breed has the disadvantage for

table purposes of having yellow legs and to a more or less extent yellow-tinted skin. It would appear that this breed should be marketed young, not more than 18 weeks of age when brought into the fattening crates, to obtain the best results for table purposes.

Rhode Island Reds.—The young chickens in this breed were not in many cases well-fleshed on the breast, and in addition showed marked yellowness of skin. Chickens which had reached a greater age, 18 weeks and over, before they were brought to the fattening crates showed a great improvement and produced table birds having an almost white skin and well-fleshed breast. The Rhode Island Reds were never such ready feeders when first crate-fed as were other breeds in the experiments.

White Leghorns.—Up to the age of eight weeks this breed almost kept pace with the growth of the heavy breeds. This was particularly so in the case of cockerels. When placed in fattening crates they were wild and restless and never settled down as did the heavy breeds. They were seldom good feeders and might have shown better results if they had been put on to cram without any preliminary crate-feeding.

Market Stages.—The following remarks on each of the market stages may also be of interest.

Petits Poussins.—The petit poussin, which meets with the greatest demand, is one weighing about 16 oz. dead weight. The market requires these in ½ doz. or 1 doz. lots, and the chickens in each lot should be as uniform as possible in size, appearance and condition. There is little demand for these birds after the end of June. Chickens hatched during the first four months of the year attain a size best suited for sale as petits poussins (16 oz. dead weight at about eight weeks of age), the chicken hatched late taking a little more time than this to reach a suitable size. The figures given below show the highest and lowest prices realized for petits poussins :—

Dates between which marketing took place	Lowest price obtained per poussin	Highest price obtained per poussin
March 3-April 6	2/3	3/–
April 19-May 28	1/9	2/3
June 10-July 6	1/3	1/8

"*Off-the-Run*" *Chickens.*—There appears to be little to choose either in the amount of live weight produced or in the cost of food per pound of live weight produced between the Indian Game × Light Sussex, Silver Grey Dorking × Light Sussex, Light Sussex and White Wyandotte. The Rhode

Island Reds did not reach the same weights as the foregoing and cost more in feeding to produce each pound of live weight. The White Leghorns, as might be expected, of the breeds under experiment, appeared to show the poorest results.

Crate-Fed Chickens.—Crate feeding extended over a period of 14 days, so that all breeds were comparable. In commercial practice the crate feeding would only be carried out so long as was deemed advisable for each individual bird, and to obtain the most profitable results some chickens would be put on to cram before the end of 14 days. In all cases the appearance and market qualities of the birds were improved by crate feeding, and as a rule the price returned per pound was higher in the case of crate-fed birds than in the case of the birds sold straight off the run.

Crammed Chickens.—The appearance and market qualities of the chicken marketed after cramming were superior to the crate-fed chicken, and the prices per pound returned for crammed chickens were usually in excess of the prices returned for crate-fed chickens. So far as the market returns were concerned, the highest prices per pound appeared to be obtained about the end of May and the lowest prices during October.

Feathers.—When disposing of feathers, 11½d. per pound was obtained for white body feathers and 4d. per pound for mixed colours. These prices were for body feathers from which the wing and tail feathers had been kept separate when plucking.

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OCTOBER ON THE FARM

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Seasonal Notes.—In the old Latin calendar the year began in March, hence the eighth month was called October; to the Anglo-Saxons it was known as wine month and as Winterfylleth, in allusion to the winter, which they regarded as beginning with full moon in this month. In Slavonic countries October is called the yellow month, because of the fading of tree leaves. Regarding the last phenomenon, it may be mentioned that there is an old idea both in this country and abroad that a severe winter may be expected when during October many leaves wither on the boughs and hang there. This observation, however, must be considered in relation to the kind of tree. There is a considerable difference in the

ordinary date of leaf-fall in the case of the horse-chestnut, sycamore and ash on the one hand, and young oaks and beeches on the other: the latter often retain their leaves until the approach of spring.

October bears much the same character in the fall of the year as April does in the spring. The commencement of the month is frequently distinguished by the lingering of summer warmth and the end by night frosts and sometimes a fall of snow. It is a month as various as April—clear skies and fogs, drought and rain, sunshine and storm, often in rapid succession. In almost every European country the expectation of a spell of fine weather in this month is proverbial: we speak of St. Luke's little summer; and if ever there was a year when the twelve fine days (which the German proverb associates with October) were necessary, it is surely this year.

The similarity between the seasons of 1927 and 1918 recalls the ancient theory of astronomic periods and their influence on the weather. It was thought that at the end of a certain number of years the days succeeded each other with the same characteristics as in the preceding period. The difficulty, of course, was to find out where the one period ended and the next began. At one time it was widely believed that the weather period was nine years, and the adoption of nine-year leases in the letting of farms is thought to have been based on the belief that in so many years the tenant would have a proper share of the good and bad seasons. A semblance of scientific support was given to the nine-year period when it was pointed out that about every nine years (eight years and 10 months) the full moons and the new moons are to be found in the same conditions and distances from the earth. Another astronomic period is that of 18 years, based on the fact that every 18 years (18 years and 11 days) the sun, the moon and the earth occupy the same relative positions; accordingly it is the period of eclipses. On comparing the seasons 1927 and 1909, considerable resemblance will certainly be noticed—a dry spring followed by a wet summer and autumn.

Field Operations.—In all parts of the country farm work is in a very backward state. How to occupy the men has taxed the resources of even the best managers. A few days ago I asked a farmer (who was spending the day with me visiting pedigree herds of cattle) what he had arranged for his men to do during his absence: it was a very wet day and the night had left pools of water in the fields. His reply was as follows:

"Well, my head waggoner came to me this morning and said, 'What about it to-day, Master?' I said, 'Grease your tackle.' He replied, 'What, again, sir?' I said, 'Well, first thing you can go and have a swim; then you can sweep the barn floor again; then you can go to the village and buy a bob's worth of marbles. I shall be away to-day.'"

Where wheat follows clover leas, the requisite manuring and ploughing will doubtless have been completed during the intervals when weather conditions interrupted the corn harvest. The lea furrow should, it is generally considered, be allowed to lie five or six weeks to become decayed before sowing. Where earlier ploughing was impossible, however, an opportunity should be taken to deal with this part of the arable land; but instead of ploughing about 5 in. deep, as would be done in August or early September, the first operation in this case should be skim ploughing; the turf should then be worked out with tine implements and afterwards buried under a fairly deep furrow, with the aid of a skim coulter. Wheat does not come well if sown on a late-ploughed lea furrow, unless the above procedure is adopted. Where little time can be allowed to elapse between the breaking up of the lea and the drilling of the wheat, it is desirable that the establishment of the wheat seedlings should be assisted by the application of a dressing of artificial manures, including a little nitrogen.

The breaking up of stubbles intended for wheat will be given precedence over the work of preparing for next season's root crops, although no opportunity should be lost which might properly be used for cleaning stubbles intended for sugar beet and mangolds, which are not very tolerant of spring cleaning operations. Unfortunately first-corn-crop stubbles this year are not so clean as usual and it will not be practicable to give them a thorough cleaning without causing delay in sowing, unless, of course, conditions are unusually good. What appears to be the best policy in the circumstances is to sow immediately after ploughing; to be rather liberal in the allowance of seed; and to make full use of artificial manures as a means of suppressing such weeds as may survive the deep ploughing with a skim coulter.

Beans.—Some farmers sow beans as their second grain crop, and there is something to be said in favour of the inclusion of an area of this crop where a fair acreage of arable land is cultivated. The winter varieties are not fastidious as to class

of soil; a good, fine tilth is not essential; the crop stands well and is not troubled by sparrows, while bad weather at harvest time does not injure the bean crop so much as it does white corn. Against the risk of bean aphis may be placed the fact that it is little troubled by other pests that affect wheat —smut, frit fly, wheat bulb fly, slugs and wireworm. In recent years, however, the possibility of serious loss from chocolate spot disease has been recognized. With the upward tendency in the price of protein-rich foods, the value of beans as a source of protein becomes more important. Where the land is not very dirty, the crop may be sown by drilling in the bottom of every second furrow, which will allow the beans to come up in rows about 20 to 22 in. apart according to the width of ploughing. The seedlings come quite well through a depth of 5 in. Where the subsequent horse-hoeing is likely to be more important, however, and the beans are expected to be a cleaning crop, it is advantageous to plough the land twice, then ridge up as for roots and drill the seed before splitting the ridges. This is an old practice, followed in East Lothian, for instance, before the replacement of the bean crop by potatoes in the rotation.

Root Harvest.—Potato tops died down, as a result of blight, early in September, and many queries have been received as to what is the best policy with regard to the harvesting and marketing of the crop. In the Midlands, at any rate, the effect of the disease has been to reduce the yield of the crop by at least 25 per cent., but as yet the tubers do not appear to have been browned to any great extent. As regards the lifting of the crop, apart from the quantities required for immediate sale, the best policy is that of leaving the tubers in the soil until the skin is quite firm. Lifting the crop early, because the tops have died down from disease, is likely to encourage the spread of the disease among the tubers rather than prevent it. Special care should be taken to have the tubers dry in the clamps. Visibly diseased potatoes should be sorted out at lifting time; the heaps should be not more than 4 ft. wide at the base, and the heavy soiling over should be delayed until there is risk of frost. A good method of ventilating the heap is that of drawing a pole along under the straw at the ridge when covering the heap. This makes a channel, which may for a time be left open at both ends.

Swedes are not ready for lifting until November, but mangolds—after last year's experience—will probably be

secured as early in October as conditions will allow. Sugar beets are less susceptible to frost injury than mangolds, and there is a certain amount of evidence that the percentage of sugar in the root increases if the crop is left in the ground till November, but further research on this subject is needed before it is possible to indicate the optimum time for lifting beet. Further information is also required on the matter of the loss in weight after clamping.

Live Stock.—October is a busy month for the shepherd on the arable farm, as it is the beginning of his winter season and the folding of roots has commenced. Skilled flock masters emphasize the desirability of giving an allowance of dry food, especially to ewes, and they regard dry food as even more important in seasons when green keep is abundant than when it is scarce. On grass farms this is the time of the year when moist meadows should be free of sheep, as at this season the sheep are liable to pick up the fluke embryo on such land. Cases of foot-rot call for special attention, in the endeavour to effect a cure before winter, and in the case of ewes before they are heavy in lamb.

Damp land is also dangerous for calves, but even on dry land calves under about nine months old are better kept indoors and rack fed as October comes in. Yearlings and older dry stock continue to thrive out of doors as long as keep allows, provided there is some shelter. This year there is abundance of grass to be cleared.

As regards the dairy herd, the duration of the grazing season is in some cases limited by the fact that the cows have to come up for milking twice a day; and under wet conditions the gateways may become almost impassable after the middle of October. Dirty gateways also increase the difficulties of producing really clean milk, for unless the cows' udders are washed before each milking there is risk of milk taints. Incidentally it may be mentioned that every case of so-called "turnip taint" that has come before my notice has responded to the simple treatment of washing the udders with an antiseptic fluid.

Apart from the above-mentioned difficulty, together with in some cases that of severely poaching the sward of the pasture—and on the heavy soils of the Midlands such poaching is certainly not beneficial—it is desirable to keep the cows out of doors as long as possible. A common mistake is that of keeping the cow-shed too warm at nights after the cows begin

to lie in, with the result that they become delicate and do not grow their proper length of winter coat. When they are turned out for exercise in winter such animals hang about the gateway bellowing to come in instead of grazing. In contrast with this there have come to notice several herds where the roots are fed on the grass in all weathers throughout the winter and the cows benefit from the longer time spent in the open.

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NOTES ON MANURES FOR OCTOBER

H. V. GARNER, M.A.,

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Management of Farmyard Manure.—In spite of the increased use of artificial fertilizers, farmyard manure is still the main source of fertility in mixed farming. It provides a complete plant food with a distinct residual effect, improves the physical conditions of the soil, and furnishes micro-organisms with a medium in which they can multiply to produce that live and mellow condition of the soil which is so favourable to crop growth. Against this must be put the fact that dung is heavy and bulky and is sometimes difficult to get out on the land when required, and that by careless handling a large proportion of its fertilizing value may be lost. Most of the farmyard manure made is enriched by feeding purchased concentrates: thus a recent estimate places the annual supply of oil cakes at about 1½ million tons, and of wheat offals at about 2 million tons. Enormous quantities of oats, barley and maize are also fed to stock, but their manurial values per ton are considerably lower than in the case of oil cakes and wheat offals. The richer the feeding the greater the manurial value of the fresh farmyard manure, and the more need for care in making and storing it. A certain amount of rotting is desirable in farmyard manure to improve it manurial action, and, incidentally, to make it easier to handle; and this fermentation is bound up with unavoidable losses, which even under the best management amount to about 15 per cent. of the nitrogen fed.

On the other hand, Voelcker and Hall in their Compensation Tables (1914) estimated that under ordinary management 50 per cent. of the nitrogen and 75 per cent. of the phosphate and potash in the food found their way into the farmyard manure, while a recent committee which has reconsidered the question (*see* this JOURNAL, August, 1927, p. 401) suggests

that the estimate of the percentage of nitrogen to be recovered in the manure should be reduced to 40. There is therefore a considerable span between the best practice and ordinary attainment in the management of dung, and while it is recognized that conditions imposed by existing buildings and yards often render ideal treatment impracticable, a good deal can be done without incurring much expense. There are few branches of farming in which it is more necessary to hold a nice balance between what is scientifically desirable and what is commercially practicable than in the management of farmyard manure. With this in mind, the following points make for quality in the final product :—

(1) The absorption of the liquid manure, which is the most valuable part of the whole, by using sufficient litter. Failing this the liquid may be conducted to a tank, admixed with as little surface water as possible, and either carried out to grass land as convenient or else pumped over the dung before the yards are to be cleared.

(2) Small and deep yards with the surrounding buildings well guttered make better dung than extensive and shallow yards.

(3) Dung loses least when moved as little as possible, and if made up into heaps these should be compact.

(4) Promptness in spreading and ploughing in dung in the field avoids the loss of nitrogen which can be quite serious when manure is exposed in dry warm weather.

Green Manuring.—Green manuring has not up to the present found its way very generally into English farming. One practice, however, appears to be well established ; namely, the ploughing in of mustard sown on a bare fallow for the benefit of the following wheat crop. Several benefits arise from this procedure :—

(*a*) The stems of the mustard open up the land and improve aeration and drainage, a very useful effect on the class of land on which bare fallows are usually taken.

(*b*) The decay of the plant residues ultimately adds to the supply of soil organic matter.

(*c*) The nitrates formed in the course of the fallowing operations are taken up by the mustard plant and fixed in the organic form, and thus saved from loss by leaching in the winter. Nitrates are gradually released again for the wheat crop when the organic substances are broken down by soil micro-organisms.

From the point of view of the first two of these effects a large bulk of plant material is desirable, *i.e.*, a heavy crop of green stuff. Mustard fulfils this condition well as it is a rapid grower. The readiness with which a green crop hands on its nitrogen to the succeeding crop depends to some extent on its state of maturity. Young sappy growth is more active in this respect than mature, drier and more fibrous material. Thus in practice a compromise has to be drawn between bulk and ready decomposition and nitrification.

The higher the nitrogen content of the green manuring crop the more effective will it be, other things being equal, as a means of enriching the soil in nitrogen, and on this account leguminous crops such as tares and trifolium might be preferred for this purpose. Owing to their slower growth and the more expensive seeding these crops have not displaced mustard as a preparation for winter-sown crops. In certain circumstances, however, they may usefully be sown in autumn for ploughing down in the following spring.

Season and Fertilizer Action.—It is well recognized that the success of manurial treatment is largely decided by the nature of the season. The subject is important, and is only just beginning to receive quantitative study, owing, no doubt, to the difficulty of disentangling the effects of the individual factors which go to make up the season. Certain broad relations between season and fertilizer action are recognized, but they depend more on extended observation than on exact data, and most of them are connected with the most obvious seasonal characteristic, namely the rainfall. Excessive dressings of nitrogenous fertilizers give trouble in a wet season, tending to delay ripening and lodge the cereal crops. Under wet and late conditions phosphatic manures exert their best effect, which is the exact opposite of that of nitrogen. In the Rothamsted experiments on potatoes, in which a series of different fertilizer mixtures have been tested for a number of seasons under ordinary farming conditions, it appears that the potash effect is most marked in dry years, that is to say, in a droughty season the mixtures containing a relatively high proportion of potash will be the most successful. Also dependent on the winter rainfall is the return from autumn dressings of organic manures or of cyanamide, as the loss of nitrate from these sources may be considerable in wet periods, especially in open soils. The same thing can happen in the case of heavy falls of rain following a spring dressing of nitrate of soda.

Drought, on the other hand, hinders the action of fertilizers, and in extreme cases where a dry period follows a heavy dressing of soluble salts applied in the seed bed actual injury to the seedlings may result. Farmyard manure and potash fertilizers may do something to mitigate the effects of a dry year. The uncertain results of insoluble phosphates on grass land in dry seasons have frequently been observed, and experience tends to localize the use of these manures in those areas where ample rainfall can be expected. Low temperatures impair the action of organic manures and ammonium salts by delaying the rate of nitrification as indicated by the yellowing of the leaves of cereals in severe cold spells in spring. Under such conditions nitrates have the advantage.

Fertilizer Prices.—There is some inducement for farmers to maintain and in many cases to extend their use of fertilizers, in view of the fact that they have not on the whole suffered the same considerable rise above pre-war prices as have most of the commodities purchased for the farm. Below will be found figures showing for a few of the common fertilizers the level of prices of the three pre-war years, the average prices for 1926 and the early autumn prices of the present season.

		1911-13	1926	August 31, 1927
Nitrate of soda ..	per ton	£10 13 0	£13 4 0	£12 7 0
Sulphate of ammonia	,,	13 9 0	12 11 0	9 18 0
Superphosphate 30%	,,	2 10 9	2 18 0	2 15 0
Slag 30% ..	,,	1 14 6	2 8 0	2 15 0
Kainit 14% ..	,,	2 10 0	2 17 0	2 16 0

NOTE.—Pre-war prices are ex works, the others are f.o.r. Sulphate of ammonia prices are f.o.r. in 1911-13 and delivered in the other years.

It will be seen that on the whole the increase above pre-war prices has been very moderate, basic slag showing the greatest difference. In the case of sulphate of ammonia the cost is considerably less now than it was either a year ago or in pre-war days. Artificial manures are therefore to be regarded as one of the relatively low-priced items in the cost of production of farm crops, and it would be ill advised to stint expenditure in this direction. Under good management the returns from fertilizers judiciously used should be quite satisfactory.

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PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending September 7				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 5	11 5	14 6
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 0*	10 0*	10 0*	10 0*	9 9
Calcium cyanamide (N. 19%) ..	8 8‡	8 8‡	8 8‡	8 8†	8 10
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 16	4 0
Potash salts (Pot. 30%)	4 17	..	..	4 12	3 1
,, (Pot. 20%)	3 12	3 2	3 7	3 4	3 2
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 5	3 5
Sulphate ,, ,, (Pot. 48-51½%)	11 10	10 5	10 16	11 2	4 4
Basic Slag (T.P. 32%)	3 8§	3 3§	3 3§	..	..
,, (T.P. 30%)	3 6§	3 1§	3 1§	2 15*e*	1 10
,, (T.P. 28%)	..	2 12§	2 13§	.	..
,, (T.P. 26%)	..	2 6§	2 7§	..	..
,, (T.P. 24%)	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10*d*	0 10
Fine grade‖	2 10	..	..	2 7*d*	0 10
Superphosphate (S.P. 35%) ..	..	..	3 4	3 0	1 9
,, (S.P. 33%) ..	..	..	3 2	..	..
,, (S.P. 30%) ..	..	2 15	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	6 0†	6 2†	6 5	5 17	..

Abbreviations: N. = Nitrogen; S.P. = Soluble Phosphate; T.P. = Total Phosphate; Pot. = Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station.

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of towns mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Prices for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.O.R. Northern rails . 6d. per ton extra on Southern rails.

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NOTES ON FEEDING STUFFS FOR OCTOBER

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The Feeding of Sugar Beet Tops.—In the notes for last month, it was shown, by means of data obtained in a recent feeding trial carried out at Cambridge, that sugar beet tops constitute a palatable feed of very satisfactory composition and nutritive value. By utilizing these crop residues, the farmer is enabled to continue the feeding of succulent green food to his animals well on towards the closing of the year, at a time when his pastures are lying inactive under the spell of winter dormancy. Thus the beneficial effects of both green fodder and root (*i.e.*, leaf and crown) are conferred on his animals in an essentially economical manner. Indeed, the yield of beet tops should prove a boon to those farmers who, as yet, have not found themselves in the position to take up ensilage as a regular feature of their farming practice. As with most other feeding stuffs, however, it is necessary, if the full benefits are to be secured, that certain precautions should be observed when utilizing the tops for feeding purposes. Some of these precautions, and the reasons for them, are considered below.

The presence of injurious or toxic substances in a feeding stuff may, obviously, seriously limit its value, even though it contains satisfactory amounts of digestible nutrients. Kellner describes the presence of considerable amounts of oxalic acid in unwilted beet leaves, the actual percentage displaying large seasonal and climatic variations. Other German investigators have demonstrated that this acid may form as much as 6 per cent. of the dry matter of the leaves. Small amounts of oxalic acid may be consumed by the farm animal without serious effects, beyond perhaps a tendency to cause slight "scouring." Larger amounts, on the other hand, may produce grave symptoms and even death, as will be appreciated by those readers who recall the efforts of certain ill-starred individuals during the war to enlarge their limited dietary by the use of cooked rhubarb leaves.

The writer hastens to state, however, that he has yet to come across a case of oxalic acid poisoning among animals which have been given access to sugar beet tops. The explanation of this clean record must be sought in the following considerations. When beet tops are wilted in the field, changes occur in the leaves which lead to a partial destruction of the oxalic acid constituent. The results of German experiments

have shown that a period of fourteen days' wilting is sufficient to halve the oxalic acid content of sugar beet tops. It would further appear that the major destruction of oxalic acid occurs during the first few days of wilting.

Fresh, unwilted tops should never, on any account, be fed to farm stock. A period of about a week's wilting should always be allowed. Fortunately, in actual practice, this is almost inevitable, since the animals usually follow on after the beets are cleared. In conversations with farmers, however, the writer has been told of cases where the animals have been permitted, apparently without serious results, to eat off the leaves from the still growing crop some short time before harvesting, the object being to reduce the amount of foliage to be handled. This is a practice which cannot be condemned too strongly. The stockowner who continues to adopt this "economical" method of topping will, in some unfortunate season of high oxalic acid content, find himself involved in disaster. The German scientists who have worked on this question have warned the farmer in the strongest possible terms against such a practice.

Artificial drying of the tops leads to an even greater destruction of oxalic acid than does wilting. This, then, is a circumstance which commends to the favourable consideration of those concerned in this country the German practice of drying down large masses of tops for winter use. Even after wilting or drying, however, the beet tops may still contain an unpleasantly high percentage of oxalic acid. A further safeguard now comes into play, since this toxic acid undergoes still further destruction as a result of fermentative activity in the first stomach of the ruminant. That so few cases of trouble have been reported as a result of feeding animals on beet tops is an indication, in all probability, that this preventive mechanism is very efficient. With pigs and horses, however, this safeguarding arrangement is absent, and it would follow that beet tops are a much safer food for sheep and cattle than for the first-named animals.

The farmer who wishes to avoid all possible risk of oxalic acid poisoning should give some precipitated chalk along with the beet tops. The effect of the chalk is to render the oxalic acid insoluble and therefore unavailable to the animal. Kellner recommends the addition of ¼ lb. of chalk to about 300 lb. of tops.

If, however, the addition of lime to tops renders the oxalic acid unavailable, then conversely it follows that the oxalic

acid in the tops must reciprocally render the lime in the animal's ration unavailable. Thus the feeding of beet tops to stock may be attended with a serious disadvantage, to which, so far as the writer is aware, attention has not previously been directed, namely, that such a fodder not only fails to supply the animal with available lime itself, but may also render unavailable the lime in such feeding stuffs as are fed along with the tops. The results for the lime balances in the Cambridge experiment certainly indicated that some such factor was operating. This form of lime starvation might have undesirable consequences when the tops are being fed to the ewe flock or the dairy herd, and it would appear desirable, in such circumstances, to allow the animals access to lime compounds (*e.g.*, a mixture of precipitated chalk and steamed bone flour) in order to avoid a deficit of lime in the ration.

Beet tops may remain wilting in the fields for considerable periods without losing their wholesome character. With the first signs of decomposition, however, feeding should be discontinued, and the residual tops should be ploughed into the land. Putrefying tops may prove anything but an economical feed, as any thinking farmer can realize for himself.

The earth which adheres to the leaves may seriously impair the nutritive qualities of the beet tops, leading not only to irritation of the walls of the intestinal tract, but also to the introduction of harmful bacteria into the animal. A little extra care exercised in the field, however, enables this difficulty to be surmounted. After topping, the leaves should be shaken vigorously to remove adhering soil, and the tops should be gathered straightway into small, convenient heaps, to prevent their being trampled on and thus rendered earthy and unwholesome. Once the farmer is convinced of the good nutritive value of sugar beet tops, he will scarcely fail to insist that this little extra trouble be taken, in order that his animals may be able to secure the food under the best possible conditions.

It should finally be remembered that beet leaves, on account of their succulent nature, tend to have a loosening effect on the bowels of the animal. Beet tops should, therefore, be fed along with a more fibrous food, like hay. Kellner suggests that a third of the total ration of the dairy cow may suitably be composed of beet tops, while fattening bullocks may be given larger allowances.

In the notes for next month it is hoped to deal with some aspects of the problem of preserving sugar beet tops in the form of silage.

DESCRIPTION	Price per qr. s. d.	lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	11 15	0 13	11 2	72	3 1	1·65	9·6
Barley, Karachi	39 3	400	11 0	0 10	10 10	71	2 11	1·56	6·2
„ Moroccan	39 0	„	10 18†	0 10	10 8	71	2 11	1·56	6·2
„ Persian	40 0	„	11 3	0 10	10 13	71	3 0	1·61	6·2
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1·70	7·6
„ „ black and grey	—	—	9 7	0 11	8 16	60	2 11	1·56	7·6
„ Scotch white	—	—	11 10	0 11	10 19	60	3 8	1·96	7·6
„ Canadian feed	28 6	320	10 0	0 11	9 9	60	3 2	1·70	7·6
„ New Zealand	33 3	„	11 13	0 11	11 2	60	3 8	1·96	7·6
„ American	27 6	„	9 12	0 11	9 1	60	3 0	1·61	7·6
„ Argentine	28 0	„	9 17	0 11	9 6	60	3 1	1·65	7·6
„ Chilian	28 3	„	9 18	0 11	9 7	60	3 1	1·65	7·6
Maize, Argentine	36 6	480	8 10	0 10	8 0	81	2 0	1·07	6·8
„ South African	42 6	„	9 18‖	0 10	9 8	81	2 4	1·25	6·8
Peas, Japanese	—	—	21 15†	1 2	20 13	60	6 0	3·21	18
Dari, Egyptian	—	—	10 10	0 12	9 18	74	2 8	1·43	7·2
Millers' offals—									
Bran, British	—	—	8 0	1 3	6 17	42	3 3	1·74	10
„ broad	—	—	9 0	1 3	7 17	42	3 9	2·01	10
Middlings, fine, imported	—	—	10 2	0 18	9 4	69	2 8	1·43	12
„ coarse, British	—	—	9 12	0 18	8 14	58	3 0	1·61	11
Pollards, imported	—	—	8 5	1 3	7 2	60	2 4	1·25	11
Meal, barley	—	—	12 10	0 10	12 0	71	3 5	1·83	6·2
„ maize	—	—	9 5	0 10	8 15	81	2 2	1·16	6·8
„ „ yellow, S. African	—	—	8 17	0 10	8 7	81	2 1	1·12	6·8
„ „ germ	—	—	9 5	0 16	8 9	85	2 0	1·07	10
„ „ gluten feed	—	—	9 0	1 1	7 19	76	2 1	1·12	19
„ locust bean	—	—	8 17	0 8	8 9	71	2 5	1·29	3·6
„ bean	—	—	12 0	1 6	10 14	66	3 3	1·74	20
„ fish	—	—	21 0	3 10	17 10	53	6 7	3·53	48
Maize, cooked flaked	—	—	10 15	0 10	10 5	85	2 4	1·25	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 7	1 10	10 17	74	2 11	1·56	25
„ „ „ 10% „	—	—	12 0	1 10	10 10	74	2 10	1·52	25
„ „ „ 9% „	—	—	11 15	1 10	10 5	74	2 9	1·47	25
Soya bean „ „ 6% „	—	—	11 10	2 3	9 7	69	2 9	1·47	36
Cottonseed cake „ 5½% „	—	—	7 7	1 8	5 19	42	2 10	1·52	17
„ „ Egyptian, 5½% „	—	—	7 2	1 8	5 14	42	2 9	1·47	17
Decorticated cottonseed meal, 7% oil	—	—	11 2†	2 3	8 19	74	2 5	1·29	35
Coconut cake, 6% oil	—	—	9 10	1 5	8 5	79	2 1	1·12	16
Ground-nut cake, 7% oil	—	—	10 0†	1 8	8 12	57	3 0	1·61	27
Decorticated ground-nut cake, 7% oil	—	—	11 10*	2 3	9 7	73	2 7	1·38	41
Palm kernel cake, 6% oil	—	—	9 0	0 18	8 2	75	2 2	1·16	17
„ „ „ meal, 6% oil	—	—	9 5*	0 18	8 7	75	2 3	1·20	17
„ „ „ „ 2% „	—	—	8 2	0 19	7 3	71	2 0	1·07	17
Feeding treacle	—	—	6 10	0 8	6 2	51	2 5	1·29	2·7
Brewers' grains, Dried ale	—	—	7 5	0 19	6 6	49	2 7	1·38	13
„ „ „ porter	—	—	6 15	0 19	5 16	49	2 4	1·25	13
„ „ Wet ale	—	—	0 16	0 7	0 9	15	0 7	0·31	4·8
„ „ „ porter	—	—	0 12	0 7	0 5	15	0 4	0·19	4·8
Malt culms	—	—	6 5†	1 8	4 17	43	2 3	1·20	16

* At Hull. † At Bristol. ‖ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of August and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is £1 2s. per ton. The food value per ton is therefore £8 18s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 11s. 0d.; P_2O_5, 3s. 8d.; K_2O, 3s. 0d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	11 0
Maize	81	6·8	9 4
Decorticated ground nut cake	73	41·0	11 10
„ cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·72 shillings, and per unit protein equivalent, 0·77 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1926, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	10 3
Oats	60	7·6	8 9
Barley	71	6·2	9 18
Potatoes	18	0·6	2 9
Swedes	7	0·7	1 0
Mangolds	7	0·4	0 19
Beans	66	20·0	9 15
Good meadow hay	31	4·6	4 8
Good oat straw	17	0·9	2 7
Good clover hay	32	7·0	4 12
Vetch and oat silage	13	1·6	1 17
Barley straw	19	0·7	2 12
Wheat straw	11	0·1	1 10
Bean straw	19	1·7	2 13

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MISCELLANEOUS NOTES

Testing New Varieties of Fruit Trees

TRIALS of new varieties of fruit trees were undertaken by the Royal Horticultural Society jointly with the Ministry in 1923 to aid the market fruit grower in the selection of new varieties for commercial purposes, and to provide growers with reliable information, not hitherto available, as to the characteristics of the newer varieties. This it is hoped will assist them in the selection of varieties for planting, and will, moreover, assure official recognition and wide publicity to really good varieties.

The conduct of the trials is in the hands of a Joint Committee of representatives of the Ministry and the Royal Horticultural Society. The gardens of the Society at Wisley, Surrey, serve as the Central Station, where all varieties entered for the scheme are grown and tested in the first instance. Those varieties which show sufficient merit at the Central Station are to be sent for further tests to sub-stations situated in fruit-growing districts throughout the country. Arrangements have already been made to establish sub-stations at Perdiswell (Worcestershire), Long Ashton (Somerset), Merton (Surrey), Osgodby (Yorkshire), Wisbech (Isle of Ely) (bush fruit only), Emneth (Norfolk), Saltash (Cornwall), East Malling (Kent), and Cambridge, and another is contemplated in the North of England.

The scheme embraces both top and bush fruits and nuts. Raisers whose varieties after inspection of the fruit promise to be useful for market purposes are asked to send sufficient plants, buds or grafts to allow the following number of trees, bushes or plants of each variety to be grown :—

Apples and Pears	20 half standards plus 20 bushes.
Plums, Cherries	20 half standards.
Nuts	20 bushes.
Currants, Gooseberries, Raspberries and other berries	20 bushes or canes.
Strawberries	100 plants.

The buds or grafts are " worked " on approved stocks before being planted. A nursery for the propagation of the stocks, trees and bushes is maintained at the Central Station. In no circumstances will the Central Station or any sub-station permit plants, buds or grafts to be taken off the stations. After consideration of the reports of the recording staff and of selected specialists, the Committee will issue reports in which re-

commendations of special varieties will be made. No report on a variety will, however, be issued until sufficient time has elapsed to enable a fair test to be carried out.

A collection of standard varieties of fruit is maintained at the Central Station and is available for comparison of the characteristics of the varieties under trial. This collection comprises the following number of varieties or supposed varieties :—

Apples	340	Raspberries	141
Pears	145	Strawberries	10
Plums and Damsons	65	Other berries	17
Red Currants	165	Quince	6
White Currants	39	Cherries	8
Black Currants	5	Nuts	9
Gooseberries	51		

In April last the trial and nursery grounds covered an area of over 17½ acres, and the numbers of varieties under trial were as follows :—

Apples	72	White Currants	2
Pears	8	Gooseberries	14
Plums	13	Raspberries	30
Damsons	2	Strawberries	5
Cherries	6	Other berries	4
Red Currants	14	Nuts	1
Black Currants	37		

The trees and plants established in the trial grounds at the Central Station have made satisfactory growth, and those that have reached bearing age have cropped well. In particular certain Red and Black Currants and Raspberries are giving interesting results, their crops being well above commercial average in quality and apparently also in weight. Several varieties of Apples show promise of some commercial value.

Certain varieties have already shown sufficient merit at the Central Station to warrant further tests. In the autumn of 1925 the Committee selected the following varieties of Black Currants and Raspberries for distribution to sub-stations :—

Black Currants—

"Baldwin"
"Seabrook's Black"
"Goliath"
"Boskoop Giant"
} Standard varieties for comparison ;

and the following new introductions :—

"Westwick A" (Col. Petre, Westwick, Norwich);
"Davison's Eight" (Col. Petre, Westwick, Norwich);
"September Black" (Messrs. Daniels, Norwich);
"Blacksmith" (Messrs. Laxton, Bedford);
"Taylor 71/23" (G. Taylor, Portobello, Midlothian).

Raspberries—

"Baumforth's Seedling A" }
"Baumforth's Seedling B" }
"Pyne's Royal" } Standard varieties for comparison;
"Lloyd George" }
"Devon" }

and the following new introductions :—
"Bountiful" (Messrs. Laxton);
"Red Cross" (G. Pyne, Topsham, Devon).

Twenty bushes or canes of each variety were sent to the sub-stations at Osgodby, Perdiswell, Merton, and Long Ashton, and a year later to the more recently established sub-stations at Wisbech, Emneth, and Saltash. Reports received subsequently indicate that the stocks made satisfactory growth at the four first-named places during 1926.

In the following autumn two other varieties of Black Currants and four varieties of Red Currants were selected for further tests at the same sub-stations. The varieties in question were:—

Black Currants—

New introductions :—
"Westwick C" (Col. Petre);
"Mite Free" (Messrs. Laxton);

Red Currants—

"Perfection" }
"Fay's Prolific" } Standard varieties for comparison;
"Wilson's Long Bunch" }

and the following new introduction :—
"Laxton's No. 1" (Messrs. Laxton).

One Apple, "Laxton's Superb," is considered by the Committee to have reached the stage for further tests, and 40 trees of this variety will be sent next autumn to each sub-station.

The Committee also decided to test at sub-stations ten new varieties of Canadian Apples now growing at the Central Station, and one tree of each variety on each of three different root-stocks was sent last autumn to each of the sub-stations at Osgodby, Perdiswell, Merton, Long Ashton, Saltash, and Emneth. These trees will provide a preliminary test to secure early evidence of the suitability of varieties for extended trials with the full complement of forty trees of each.

No Gooseberries have yet been selected for distribution to sub-stations, but many varieties cropped well during 1926, and it is anticipated that some varieties will be selected for distribution this year. No Pear or Plum has yet commenced to crop sufficiently well to afford an indication of its true commercial value.

In addition to these trials, experiments are in progress to establish the number required in any given experiment to cover experimental error and other experimental risks. Arrangements are therefore being made to provide 100 bushes of each of four varieties of Black Currants by the Central Station to the three Horticultural Research Stations at Long Ashton, East Malling, and Cambridge, where crop records from individual bushes might be kept over a period of years.

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Correspondence Classes in Agriculture

DURING the winter session 1926-27 correspondence classes were held in seven counties in England. In Lincoln (Lindsey) and East Suffolk they were arranged for the third successive session, and in Lincoln (Kesteven) and Surrey the experiment was tried for a second time. In Gloucestershire and Wiltshire a course was held under the auspices of their respective county councils on the same lines as one which was conducted during 1925-26 independently of the county authorities by the Advisory Economist of Bristol University. In Hertfordshire a class arranged primarily for teachers desiring to prepare for the examinations of the Royal Horticultural Society, has been opened to gardeners in a modified form.

The high standard of work was maintained, but the proportion of students who completed the course was rather lower than in previous years; this was more noticeable in the second-year courses, but was partly accounted for by the pressure of work on the farms in the spring.

Gloucestershire and Wiltshire.—A course in farm bookkeeping for students in the two counties was conducted by Mr. E. P. Weller, Advisory Economist, Bristol University, who prepared papers of instruction and sets of questions, which were sent to the students fortnightly. Model answers were supplied to the county staff, who corrected the papers. A fee of 10s. was paid by each student, half being returnable to students who completed the course, worked papers regularly and returned the set of instruction papers undamaged.

In Gloucestershire seven students entered, all of whom completed the course. The course was entirely satisfactory and was much appreciated by the students. The percentage of marks awarded ranged from 88·3 to 59·5. Another course will be arranged next year.

In Wiltshire 10 students enrolled, but only five completed the course. The standard of the work done was high, as was the case last year, the marks ranging from 97 per cent. to 62 per cent. Most of the students studied the papers effectively and obtained an intelligent grasp of the subject. It would, however, be of advantage for them to follow up the course with constant practice in book-keeping. Prizes were awarded to the best two students.

Hertfordshire.—A course, arranged for teachers in preparation for the Royal Horticultural Society's Teacher's Certificate, and their general examination, was thrown open in a modified form to gardeners, three of whom enrolled. The course included instruction on manuring, plant physiology, plant pests and diseases, and the growing of vegetables, fruit and flowers. Several inexpensive text-books, as well as the Ministry's leaflets dealing with the subjects studied, were prescribed for the students, who were also recommended to consult certain books of reference obtainable from the Rural Industries Headquarters Library at Hertford. The course, which extended from November 1, 1926 to February 28, 1927, consisted of eight fortnightly papers set on reading prescribed beforehand.

Lincolnshire (*Kesteven*).—Two courses were again held during the winter. The beginners studied Somerville's *Agriculture*, and the more advanced students Wood's *Chemistry of Crop Production*. Five students took the former course and four the latter; the course was completed by all with the exception of one advanced student. No fee was charged, but the pupils were required to buy their own text-books. Papers were set fortnightly for eight weeks, commencing October 18, 1926. Three prizes were given in the beginners' class and two in the advanced.

Lincolnshire (*Lindsey*).—Two courses were provided: one in crop husbandry for beginners, the other a continuation course for the previous year's students in animal husbandry. The first-year course began in November and ended in March, and the book studied was Somerville's *Agriculture*. As the book chosen for the second-year course, *The Stockfeeders' Companion*, by J. Porter, was temporarily out of print, it was not possible to begin that course till towards the end of December.

Twelve students enrolled for the former course, seven completing, while eight registered for the latter and three completed. A prize was awarded to the best student in each

class. The courses were designed for fortnightly lessons and sets of questions, but owing to the late start some of the lessons in crop husbandry were given weekly.

The answers of the students to the questions in crop husbandry showed that the text-book had been studied carefully and intelligently, but the class in animal husbandry appeared to find the subject difficult, and only two really grasped the principles underlying the scientific rationing of farm stock.

East Suffolk.—The book chosen for study, Porter's *Stock-feeders' Companion*, was out of print. The course was not started until February, when copies of the text book were available, and, as it was not possible to finish the work during the winter session, the class will be resumed this autumn with the same students.

Surrey.—Two courses were held, for beginners and for last year's students. Both began in December and ended in March.

The text-book adopted for the beginners' course on manures and manuring was the Ministry's Sectional Volume No. 8. Nine students began and six completed the course, while the remaining three worked three out of four papers of questions set. All did very well, the percentages of marks awarded on the papers ranging from 98 to 80 per cent.

The second-year students' work was based on the study of Mackintosh's *Feeding of Dairy Cows*. Only one student out of three finished the course, the remaining two relinquishing it owing to pressure of work on the farm, after answering the first series of questions

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Countrywomen's Craftwork

WHEN the National Federation of Women's Institutes held its last Handicraft Exhibition in 1924, even those within the movement were surprised by the high standard of craftsmanship attained generally by Women's Institute members, and the great beauty of some of the work shown. Visitors to that Exhibition were almost entirely members of Institutes, or persons in some way connected with the Women's Institute Movement, while all that the man in the street heard of the Exhibition was that it *had been* well worth seeing.

There are outside the Institute Movement many people keenly interested in handicraft work and many who (without being specialists) take a real interest in the country and in country life. It is hoped that these will take the opportunity

of visiting the Exhibition of Home Crafts which the National Federation of Women's Institutes has arranged this month at the Imperial Institute, South Kensington. The Exhibition will be open to the public on the afternoon of Wednesday, October 5, and throughout the day on Thursday and Friday, October 6 and 7. On Friday, October 7, at 12 noon, H.R.H. Princess Mary, Viscountess Lascelles, will visit the Exhibition.

This year's Exhibition will consist of a General Section, for which any Institute worker could enter, and a Co-operative Section, where the work shown will be the combined work of a group of Institute members, or of the members in a group of villages.

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The Agricultural Index Number

ON the average the level of prices of agricultural produce was unchanged in August at 42 per cent. above 1911-13. For six months the general index number has remained almost stationary although there have been very appreciable changes in certain individual commodities. As compared with August last year prices are lower on the average by nearly 5 per cent.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

	Percentage Increase compared with the Average of the corresponding month in 1911–13					
Month	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	42
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.—There was a slight reduction in the price of wheat during August, but the decline of 1d. per cwt. to 12s. 6d. per cwt. left the index number unchanged at 56 per cent. above the base years. With some small quantities of new crop malting barley on the market, average prices of this grain showed a sharp advance from 11s. 11d. in the first week of August to 13s. 6d. in the last week, and the index number

rose by 7 points to 64 per cent. above 1911-13. Prices of oats declined as a result of new crop marketings, but the drop on the month was relatively much less than in August of the base years and the index number advanced by 10 points to 43 per cent. above pre-war.

Live Stock.—As is usual in August fat cattle declined in price, but the decrease was relatively smaller than in the base years and the index number rose by 4 points to 34 per cent. above 1911-13. Although fat sheep became rather dearer towards the end of July prices fell away somewhat during August, and the average was unchanged on the month at 45 per cent. above 1911-13. As compared with August, 1926, fat sheep were 4 to 5 per cent. cheaper. Fat pigs continued the decline in prices which has been in evidence for some time, although in the last two weeks of August there was a slight hardening. Bacon pigs averaged 36 per cent. and porkers 43 per cent. above the prices in the base years, but 7 and 6 points respectively lower than in July and over 20 per cent. lower than in August, 1926. Store pigs also sold at lower figures, but these were still relatively dear at 70 per cent. above August, 1911-13.

Dairy and Poultry Produce.—Egg prices rose sharply during August, and as has been the case for several years, the increase was relatively greater than in the base years, so that the index number rose by 13 points to 44 per cent. above pre-war, but was 5 points lower than in August, 1926. With smaller supplies on the market, butter prices advanced during August, but as the increase was relatively smaller than in 1911-13 the index number declined by 4 points to only 38 per cent. above the base years, which was 18 points lower than a year earlier. Cheese prices showed little change, but at 57 per cent. above pre-war were nearly 10 per cent. higher than in August, 1926.

Other Commodities.—There were heavy supplies of potatoes on the markets during August and the quality was in some cases rather inferior, so that prices of early potatoes declined sharply. On the average they realized only 30 per cent. above pre-war as compared with 61 per cent. in July, but made appreciably better prices than in August last year. For the first time for several years hay has been subject to fairly appreciable price changes and the index number rose by 10 points to 16 per cent. above pre-war, relatively the highest price recorded since 1923. As a result of the poor crop plums realized nearly 2½ times the pre-war prices, while apples sold during August at about 50 per cent. above 1911-13.

Index numbers of different commodities during recent months and in August, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	Aug.	Aug.	May	June	July	Aug.
Wheat	47	69	53	60	56	56
Barley	62	52	46	54	57	64
Oats	43	33	27	33	33	43
Fat cattle	54	43	24	25	30	34
Fat sheep	76	52	53	48	45	45
Bacon pigs	82	79	58	54	43	36
Pork pigs	56	83	66	60	49	43
Dairy cows	50	37	24	21	25	25
Store cattle	39	33	23	21	26	26
Store sheep	91	63	38	53	55	48
Store pigs	57	139	99	90	80	70
Eggs	67	49	28	30	31	44
Poultry	58	55	41	53	52	43
Milk	62	60	53	53	55	55
Butter	73	56	42	41	42	38
Cheese	78	43	46	54	58	57
Potatoes	67	11	74	61	61	30
Hay	3	11	2	3	6	16
Wool	38	24	31	33	40	42

Short Courses in Clean Milk Production

BY arrangement with the National Institute for Research in Dairying, a course of instruction in the production and handling of milk will be held at the University of Reading from November 1 to 12, 1927. The course is intended primarily for Dairy Instructors and Instructresses, but other applicants, especially those who are concerned with public health administration, will be admitted if accommodation allows.

Application for admission to the course should be made in the first instance to the Dean, Faculty of Agriculture and Horticulture, The University, Reading, and intending students should travel to Reading on Monday, October 31, and be ready to commence work, if necessary, at 9 a.m. on Tuesday, November 1. The fee for tuition for the course will be £4, which must be paid to the University office.

Instruction will take the form of lectures, combined with demonstrations and laboratory work, and will deal with such matters as milk supply and production, legislation and

regulations regarding milk, applied bacteriology of milk and the chemical composition of milk. Excursions will be arranged to well-known dairy farms, factories and depots, but the travelling expenses in connexion with these are not included in the tuition fee.

The College cannot undertake to arrange residence for students, but will give all possible assistance and advice. Students are advised to take bicycles.

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Farmers' Visits to Rothamsted

FARMERS and others interested in Agriculture are reminded that the field experiments on the manuring of root crops conducted at Rothamsted provide, at this time of the year, a very striking series of demonstration plots. The most important of these experiments are :—

1. *Potatoes :—*
   (*a*) The effect of various potash manures (Sulphate of Potash, Muriate of Potash, Potash Salts).
   (*b*) The effect of different proportions of potash and nitrogen (as Sulphate of Ammonia) in presence of constant dressings of dung and superphosphate.
   (*c*) Comparison of the yields from seed potatoes fresh from Scotland with those from seed grown for various periods on the farm.
2. *Swedes :—*
   (*a*) The Classical Mangold Field is this year in Swedes, the mangolds having failed owing to the spring drought. The effect on Swedes of the various schemes of manuring is well shown.
   (*b*) Some of the newer forms of phosphate and nitrogen (Ammonium Phosphate and Urea) are being compared with Superphosphate and Sulphate of Ammonia.
3. *Sugar Beet :—*
   (*a*) The effect of different widths of drilling : 14″, 18″ and 22″ drills are being compared.
   (*b*) A comparison of the effects of Muriate of Potash and 30 per cent. potash salts.
   (*c*) Comparisons of Nitrate of Soda, Sulphate of Ammonia and Cyanamide in varying quantities.

In addition to the above experiments on root crops, the second crop of grass on the Park Hay Plots shows the effect of a number of different manurial treatments on old meadow land.

The Secretary will be glad to arrange for farmers' parties of any size to be conducted round the experimental plots at any time before lifting. In cases where it is difficult to fix a date in advance, farmers are invited to come at their own convenience, and the necessary arrangements will be made on arrival. At least three hours should be allowed for a tour

round the farm. Lunch and tea can readily be obtained in Harpenden. The Midland Railway station (Harpenden) is about half a mile from the Laboratory and the North-Eastern station about two miles. Farmers coming by road will find the Laboratory on the west side of Harpenden Common.

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Extension Lectures on Agricultural Subjects

THE Agricultural Research Lectures Scheme, which was inaugurated in the winter season 1922-23, with the object of familiarizing farmers with the agricultural research work carried on at Research Institutes and at other centres in the country, will, with slight modification, be continued in the coming season. It is intended that the lectures to be delivered shall, while still furnishing information as to the present position of research in various branches of agricultural science, be rather more popular in character than hitherto : they will be in the nature of extension lectures on agricultural subjects. The lecturers will be drawn from the staffs of Research Institutes, Advisory Centres and Agricultural Colleges. A list of lecturers, and of the subjects on which they will be prepared to lecture, has been circulated to County Authorities for Agricultural Education, who have been asked to apply direct to lecturers for their services after preliminary consultation with the local branches of the National Farmers' Union.

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Young Farmers' Clubs : International Dairy Cow Judging Contest

THE sixth International Dairy Cow Judging Contest, for the Gold Challenge Cup presented by the *Daily Mail*, took place on July 14 at the Sussex Show at Chichester, through the courtesy of the Council of the Sussex County Agricultural Society. The competing teams were as follows :—

United States of America.—Gertrude Kaiser, age 16, St. Olaf, Iowa ; Kenneth Walter, aged 16, Luana, Iowa ; Lloyd Kaiser, aged 17, McGregor, Iowa. This team was trained by Mr. Roy Combs, County Agricultural Agent, Clayton County, Iowa.

England.—Mabel Harriott, age 16 ; Leslie Cornford, age 18 ; John Harper, age 18 ; all of the Sussex Baby Beef Club, Haywards Heath. This team was trained by Mr. R. J. Noakes, the Club Leader.

The Judges were : Prof. A. C. McCandlish, West of Scotland Agricultural College, and Capt. Allan Skelton, Woodham

Ferrars, Chelmsford; the Umpire being Mr. E. A. Weir, of the Canadian National Railways.

The competitors judged three rings of Jersey, Friesian and Shorthorn cows. Twelve minutes were allowed to competitors for placing the animals and two minutes in which to give their reasons for the placing to the Judges. The animals judged were not selected from the stock on the show ground, but were brought specially in for the Contest under arrangements made by the Council of the Sussex Agricultural Society.

The contest began at 11 a.m. and lasted for two hours. The English team won by 12 points, having gained 842 points as against 830 points awarded to the American team. Mabel Harriott was placed first amongst the competitors with 283 points. Lloyd Kaiser and Gertrude Kaiser were equal last with 276 points, so that there was a difference of only 7 points between the top and bottom, showing the keen nature of the competition. The complete order of merit is as follows:—

	1.	Mabel Harriott	283 points
	2.	Leslie Cornford	282 ,,
	3.	Kenneth Walter	278 ,,
	4.	John Harper	277 ,,
equal	5.	Lloyd Kaiser	276 ,,
equal	6.	Gertrude Kaiser	276 ,,

The English team scored 427 points against the American total of 407 for "placing," but the Americans gained 423 points as against the English 415 points for "stating the reasons." According to the rules governing the contest, competitors were permitted to take notes. The members of the English team availed themselves of the rule, but the Americans have been accustomed to work without notes, and their statement of reasons before the Judges was a striking feature of the contest which no one failed to appreciate.

H.R.H. Prince Henry specially visited the Show during the afternoon to present the gold cup and silver medals to the winning team and bronze medals to the American team. He also presented prizes to members of the Young Farmers' Club teams who had taken part in other judging competitions, and to individual club members who had been successful in showing their Sussex and Jersey calves on the first day of the Show.

It is desired to place on record the very high appreciation of the valuable support which the Council of the Sussex Agricultural Society has given to the Young Farmers' Club Movement in providing so many classes for the benefit of club members at the Show, and for making such admirable arrangements for the staging of the International Judging

Contest. Deep appreciation is also recorded for the help and encouragement given to all branches of club work in East and West Sussex by the Directors of Agriculture and their staffs, and to Major E. G. Sheppard, D.S.O., M.V.O., T.D., the Secretary of the West Sussex Rural Community Council.

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The Teaching at County Farm Institutes

THERE are fifteen farm institutes in England and Wales, and all except one have demonstration farms attached. The main purpose of the teaching that is given at farm institutes is to provide instruction in the scientific principles underlying sound farming practice. The existence of the demonstration farms allows of such instruction to be closely related to practice, and this applies not only to general agriculture but also to gardening, dairying and poultry instruction. The subjects dealt with and their order of importance varies somewhat at the different institutes, but a typical curriculum includes the following : Soils, manures, crops, live stock, implements, machinery, veterinary hygiene, surveying and mensuration, farm book-keeping, general agricultural science (biology and chemistry), horticulture, dairying, poultry and bee-keeping, and fungus and insect pests. Most of the courses start in October, one term being taken before Christmas and one after, but in some cases a full year's course is given. There are also short courses in special subjects, and most of the institutes provide instruction for women, particularly in such subjects as dairying, horticulture and poultry-keeping.

This information will perhaps be of greater service if coupled with the names of the fifteen counties in which the farm institutes are situated. They are : Cheshire, Farm Institute at Reaseheath ; Cumberland and Westmorland, at Newton Rigg ; Essex, at Chelmsford ; Hampshire, at Sparsholt ; Hertfordshire, at Oaklands, St. Albans ; Holland (Lincolnshire), at Kirton ; Northamptonshire, at Moulton ; Somerset, at Cannington ; Staffordshire, at Rodbaston ; East Sussex, at Plumpton ; West Suffolk, at Hartest (the Chadacre Agricultural Institute) ; Carnarvonshire, at Madryn ; Carmarthenshire, at Carmarthen ; Denbighshire, at Ruthin ; and Monmouthshire, at Usk.

A certain number of scholarships are awarded at these institutes by the various County Councils to residents within their area, and the Ministry itself awards scholarships for the sons and daughters of agricultural workers.

Brief particulars of the courses for the sessions 1927-28 are given in the Ministry's Form No. 732/T.E., which can be had, post free, on application to the Ministry, and more detailed information can be obtained from the Principal of the institute concerned. Anyone desirous of attending one of these courses commencing in October, should make application immediately to the Principal, as accommodation at the institutes is limited.

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Varieties of Potato Immune from Wart Disease

IN the report on the Wart Disease Immunity Trials carried out at Ormskirk in 1926 (see this JOURNAL, March, 1927, p. 1156), it was stated that, in addition to the varieties mentioned therein, the Ministry was prepared to include other varieties, which had successfully passed the test, when the growers should give notice of their intention to introduce them into commerce.

This intention has now been notified in regard to the three varieties, "The Baron," "Bounty" and "Boxer," and these have accordingly been added to the official list of approved immune varieties. Descriptions of these varieties are appended.

Second-Early Variety

"*The Baron*"

Sprout.—Pink.

Tuber.—Oval; skin white; flesh white; eyes shallow.

Haulm and Foliage.—Upright to spreading, moderately vigorous; leaflets long, fairly large, dull, wrinkled, waxy appearance; stems general pink coloration; wings straight.

Flowers.—White, not numerous.

Late or Maincrop Varieties

"*Bounty*"

Sprout.—Purple.

Tuber.—Round; skin white; flesh white, texture soft; eyes medium.

Haulm and Foliage.—Strong, open, upright, moderately tall; leaflets dark bronze-green, long, wrinkled, hard and glossy in appearance; terminal leaflets drooping; secondary leaflets large, numerous; leaf closed; stems purple coloration at base and in axils of leaves; wings straight.

Flowers.—Light blue-violet, rare.

"*Boxer*"

Sprout.—Pink.

Tuber.—Round, flattish; skin white; flesh lemon; eyes fleet and sub-terminal.

Haulm and Foliage.—Tall, upright, vigorous and open; leaf erect; leaflets Quaker-green, broad, long, hard and crinkled; secondary leaflets large and numerous; leaf closed; stems green; wings straight.

Flowers.—Light blue-violet tipped white.

North Devon Cattle Feeding Trials

AN interesting experiment has been going on in north Devon in the production of baby beef. For some years the age at killing has been steadily reduced. It used to be three years old; it is now a little over a year. That means that a calf of the right stock, that is, one having the hereditary quality of early maturity, can be fed to a stage when it produces good beef—and, incidentally, the smaller joints that are required by households to-day—at a little over a year old. The experiment was arranged by the North Devon District Agricultural Committee about 18 months ago, when one of its members undertook to put four young calves under the supervision of the District Lecturer to be fed systematically according to his prescription. They were North Devon calves, de-horned soon after birth. They were fed in the stall up to 17 months old, when they were sold for beef; they were about 8 cwt. each at slaughter, and realized a trifle over £24 apiece: 60s. per live cwt. In the same market in which they were sold, the best quality beef steers and heifers of about 2¼-2½ years old, averaging 11¼ cwt., realized approximately 53s. per live cwt. The older animals, therefore, which had to be fed for a year longer, realized a good deal less per live cwt. and were not correspondingly heavier. It is not suggested that the actual profit on the sale of these 8-cwt. beasts is likely to be very high; indeed, it may merely be the value of the manure from the foods consumed. For the first fortnight the calves were fed on their mothers' milk, and each subsequently received a total of 116 gallons of new milk. The experiment aroused keen interest, and will be repeated on other farms in North Devon. Probably smaller quantities of new milk will be given, and the stock may be sold earlier if a favourable market presents itself. Had the four beasts been sold in June, they might have realized up to 70s. per live cwt. instead of 60s.

* * * * * *

Mineral Phosphates

MANY experiments have shown that finely ground mineral or rock phosphates are useful fertilizers in suitable conditions. The chief conditions in favour of the action of ground rock phosphates are: a moist climate and a soil which is strongly in need of phosphate, or rich in organic matter and not abundantly supplied with lime. Under opposite conditions, dry climate, or dry seasons and on chalky soils, they may

be expected generally to act more slowly than citric-soluble basic slags. It is to be noted, however, that Dr. Scott Robertson, in Essex, has obtained distinctly beneficial results from rock phosphates in this relatively dry area, results which only suffered by comparison with more soluble phosphates.

The proportion of phosphate of lime in ground mineral phosphate varies from 55 to 85 per cent. (some of the American phosphates contain less than 55 per cent. and those of Nauru and Ocean Island may contain slightly more than 85 per cent.), so that in practically all cases the amount of ground mineral phosphate required for the improvement of grassland would be from 5 to 6 cwt. per acre for a full application (equivalent to 10 cwt. per acre of high-grade basic slag), followed by, say, a dressing of 5 cwt. per acre every fourth year. Experience at Cockle Park, Northumberland, where a number of experiments with rock phosphates have been carried out, suggests that a suitable application of North African phosphates (containing 60 per cent. phosphate of lime) as a first dressing for the improvement of grassland, would be 6⅓ cwt. per acre, which would be equivalent to 10 cwt. of basic slag containing 38 per cent. phosphates.

The mineral phosphate, however, must be finely ground.

The bulk of the ground rock phosphate available in this country was, until recently, of the same degree of fineness as that usually guaranteed with basic slag, that is that 80 per cent. will pass through a 100-mesh (linear) sieve, *i.e.*, a sieve having 10,000 meshes per square inch. Some grinders are now, however, producing an article of even greater fineness, 80 per cent. being guaranteed to pass through a 120-mesh (linear) sieve, *i.e.*, one having 14,400 meshes per square inch. Trials with North African phosphate (containing about 60 per cent. of phosphate of lime) of the latter degree of fineness carried out at Cockle Park, Northumberland, have given such satisfactorily increased yields of grass and of arable crops as to lead to the conclusion that it was comparable with high-grade basic slag. In a series of trials carried out by the Agricultural Education Association, the North African phosphate (which, however, was not so finely ground as that used in the Cockle Park experiments) proved inferior to low soluble slag on grassland but superior to it on arable land.* It would be valuable to have further comparative trials with mineral

* The results obtained showed that, in Northumberland, finely ground mineral phosphate acts well when applied to barley in which the seeds are sown. It improves the barley and the white clover.

phosphates of different degrees of fineness, but there is considerable indirect evidence to support the view that the finer grinding is an advantage. The difference in cost between the two grades is in most cases quite small.

At Cockle Park when dressings of lime have been applied in conjunction with these phosphates it has been found that the lime retards the action of the phosphates. Before applying lime, therefore, under such conditions, it would be advisable to ascertain by trial whether it is advantageous or otherwise to do so. When ground mineral phosphate is used on pasture it is advisable, as with basic slag, to remove the stock from the grazing land until rain has washed the phosphate from the herbage.

Tests with ground rock phosphates have now been carried out in a number of counties, and any who intend to give the material a trial should inquire of their County Agricultural Organizer* as to the results that may have been obtained under local conditions and as to the possibility of obtaining supplies in the district.

* * * * * *

The Stud Goat Scheme

SMALLHOLDERS and cottagers who keep goats are reminded that the Scheme for improving the productive quality of their milch stock is again in operation. For the current breeding season, which ends on February 28, 1928, 110 stud goats have been registered, which are standing at 105 centres in various parts of the country, and their services are available for goats belonging to persons in the above-mentioned categories at a nominal fee, in no case exceeding 5s. Conditions of service and other information may be obtained from the County Agricultural Organizers at their respective County Education Offices, or from the Honorary Secretary of the British Goat Society, which is responsible for the administration of the Scheme, at 10 Lloyd's Avenue, London, E.C. 3.

* * * * * *

Foot-and-Mouth Disease. – Fresh centres of disease were discovered during the month at Kempston, Bedford, on September 2, and at Llangeinor, Bridgend, Glamorgan, on September 5. A further case occurred in the Bedford area on September 6, and further outbreaks were also confirmed on September 15 and 16 in the Glamorgan area.

Thirty-two outbreaks in all have been confirmed since January 1 last, involving 11 counties and the slaughter of 1,294 cattle, 1,167 sheep, 422 pigs and 2 goats.

* *See* Leaflet No. 279 (*Technical Advice for Farmers*), obtainable from the Ministry.

Enforcement of Minimum Rates of Wages.—During the month ending September 15 legal proceedings were instituted against nine employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Cheshire ..	Chester ..		—		0	7	6	2	0	0	1
,, ..	Broxton ..	1	0	0		—		10	7	0	4
Dorset ..	Beaminster ..	10	0	0	4	1	6	22	0	11	6
Kesteven & Lindsey	Barton-on-Humber ..	2	0	0	2	11	0	3	13	4	2
Dorset ..	Cranborne ..	10	0	0	1	2	6	28	17	0	3
Hereford ..	Kingston ..		*			—			—		1
,, ..	Ledbury ..	15	0	0	6	5	0	44	18	0	8
Montgomery	Llanfyllin ..	1	0	0	3	0	0	28	18	2	1
Hants ..	Whitchurch ..		—			—		4	7	6	1
		£39	0	0	£17	7	6	£145	11	11	27

* Case dismissed.

Proceedings were also taken against two employers under Section 9 (3) (*a*) and (*b*) of the Act (refusing information and hindering an Officer in the course of his duty). In the first case, heard at Clun (Salop), the employer was fined 10s. and ordered to pay 10s. costs, and in the second case, heard at Talgarth (Brecon), the defendant was ordered to pay 4s. costs.

* * * * * *

NOTICES OF BOOKS

All About Gardening. (London : Ward, Lock & Co., Ltd. Pp. 384. 8 colour plates, 32 photographic illustrations and 56 diagrams in the text. Price 6s. net.)

Gardening is, the publishers state, man's chief hobby, for all are at heart garden lovers, and it is only the lack of the knowledge of when, where, how and why that prevents one and all from becoming practical gardeners as well as mere garden lovers, and, believing this, the authors have designed this book, *All About Gardening*, to supply gardening knowledge in very simple, straightforward language. Gardening of to-day embraces flower gardens, lawns, rock gardens, water gardens, gardens covered with glass, vegetable gardens and fruit gardens, so it is not surprising that the mass of information—though very closely printed—extends through some 384 pages and makes a somewhat bulky book. In addition, there are eight coloured plates of typical flower gardens from paintings by Flora Pilkington and Beatrice Parsons, and of a Dutch garden from a painting by George S. Ellgood ; 32 illustrations and 56 diagrams to interest the reader in gardening and to make the text easier to understand.

The book describes fully and accurately the way a garden should be made and managed to be beautiful and useful in supplying fruit, flowers and vegetables for the home.

A large number of people with gardens attached to their homes wish to acquire a sound working knowledge of gardening, and *All About Gardening* gives just the kind of information required. Lists of useful plants have been drawn up for guidance of readers, and the plants included are good. Plant lovers, however, would wish for something more, for they realize that each plant has its special features

which are not always brought out by the standardized methods of culture described in the book. To deal with the special treatment of each plant would have necessitated a considerable expansion of the book, and if done the simplicity which the authors desire to be a special feature would have been destroyed.

The information given in the book is accurate and generally up-to-date, and it is evident that some of the writers—though not all—have kept in touch with the research work of the Horticultural Research Stations. At the price of six shillings the book is very cheap.

Plant Products. By S. Hoare Collins, M.Sc., F.I.C., and George Redington, M.Sc. (London: Bailliere, Tindall & Cox, 1926. Second edition. pp. xiv + 262. Price 10s. 6d. net.)

Readers who are familiar with the war-time edition of this book will remember that it was divided into four main parts, dealing respectively with fertilizers, soils, crops and meat production, so that, to quote the words of Mr. Collins, it covered "the cycle from factory to fertilizer, from fertilizer to field, and from field to factory once more." In the preparation of this new edition, the authors have modified to a considerable extent the earlier treatment of the subject. It has been found advisable to curtail slightly the chapters dealing with the artificial fertilizers. The section on soils has been brought up to date, although considerations of space have prevented the authors from writing on this subject as fully as might have been desired. The third part, devoted to the subject of crops and the composition of feeding stuffs, has been considerably expanded and contains some of the most interesting chapters of the book. From the fourth part, dealing with meat and milk production, all features possessing a purely war-time interest have been omitted. The writers state that "in spite of these radical changes, which have resulted in a new book, the fundamental plan is unchanged, so that those readers who know the first edition will not feel any unfamiliarity."

It will be at once apparent that the authors, in a book comprising some 260 pages, have covered a very wide field. As a consequence, many matters of importance have perforce been dealt with in a manner which may prove slightly disappointing to the scientific reader in search of detailed information. The book, however, is avowedly not intended to supply "encyclopædic completeness of information," and the reader engaged in specialistic studies will necessarily, as heretofore, have refuge in the scientific journals. This volume is one of a series of publications "giving a comprehensive survey of the chemical industries," and has obviously been compiled in an attempt to meet the special requirements of the applied chemist interested in the agricultural utilization of industrial products and by-products. To the chemist engaged in technical work in any way connected with agriculture, as well as to the reader in search of general information on questions concerning the relation of industry to agriculture, the book may therefore be recommended with every confidence.

A Bird Book for the Pocket.—By Edmund Sandars. (Oxford: The University Press, 1927. Pp. xix + 245. Over 200 coloured illustrations. Price 7s. 6d. net.)

The arrangement of this useful little handbook is admirable, the introduction well written and authoritative, and the descriptions of the various species are concise but ample. The field observations (always a criterion of value in a book on natural history) are numerous and accurate. The author is aware, for example, that the Lesser Whitethroat has a habit, when feeding its young, of hanging head downwards from a twig, although this fact has escaped the notice of many writers on ornithology. His statement, too, that all the pigeons

will drink salt water is of peculiar interest. The Rock Dove is known to do this, but that the habit extends to others of the genus is not so well-known, and such observations are valuable.

There are a few errors, though none of them serious. The breeding time of the Hobby is given as May and June, but it is doubtful whether the few British breeding Hobbies are ever engaged in nesting before the end of June or the beginning of July. It might have been made clear, also, that the Nightjar's habit of clapping its wings in flight is not confined to the courtship period, as the author's note might lead one to infer. The nomenclature is open to criticism in a few cases, as, for example, in the substitution of "Spotted Woodpecker" for "Greater Spotted Woodpecker," and "Barred Woodpecker" for "Lesser Spotted Woodpecker," although these substitutions are not very objectionable. In point of fact, the term "Barred Woodpecker" is more aptly descriptive, but "Lesser Spotted Woodpecker" remains, nevertheless, the accepted British name for this species. "Water Wagtail" is, however, misleading, as it might apply equally to both the Pied and Grey Wagtails.

The illustrations are presumably intended to be impressionist pictures rather than scientifically accurate drawings. Judged from that angle, they are good for the most part, although some are poor, and a few, such as those of the Nightingale, Spotted Flycatcher, Whitethroat, Dartford Warbler and Cuckoo, are definitely bad. It is doubtful whether the student would recognize these birds from the illustrations. Many of the drawings, too, are open to objection on anatomical grounds, or in the matter of scale. In the circumstances, the claim that the illustrations set a new standard of accuracy can hardly be upheld. The drawings of eggs, although somewhat crude, are good, but exception might be taken to the inclusion of the Nightingale's egg among those invariably uniform in colour. While it is true that the type is a uniform dun or olive brown, mottled examples are frequently found.

Apart from the illustrations, however, the book undoubtedly is a useful addition to ornithological literature at a very reasonable price, and may be commended to anyone desiring to study the habits of British birds.

Rural Industries in England and Wales. *Vol. III*, Decorative Crafts and Rural Potteries. By Helen E. FitzRandolph and M. Doriel Haye; *Vol. IV*, Wales. By Anna M. Jones. (Oxford: The Clarendon Press. Price 5s. net each).

These are the concluding volumes of the survey of rural industries, made on behalf of the Agricultural Economics Research Institute at Oxford and previously noticed in the May number of this JOURNAL. They complete successfully the survey itself, and fulfil the promise of thoroughness which was given in the first two volumes. It should be noted that the investigations were carried out under the direction of Mr. A. W. Ashby, formerly of the Oxford Research Institute, but now of the Aberystwyth University.

The Decorative Crafts and Rural Potteries dealt with in the first volume are specially interesting in these days when more attention is given than formerly to beautiful hand-made articles, especially as decorations for the home. The great selling stores in London and other of our chief towns would be incomplete without some products of such homely craftsmanship. It is quite true, as pointed out in the volume, that "the workman, shaping his material with his hands, or with tools directed by his hands, can adapt his work more exactly to the natural idiosyncrasies of the material than is possible with a machine." For that reason hand-made ironwork, cloth, lace and other

materials are usually much more beautiful and sometimes even better finished than goods turned out by machinery. The individual touch, the artistic touch, is of great importance in such articles, though it is perhaps insufficiently appraised by the public.

Apart from the purely business side of rural industries, what strikes one as being especially interesting on reading these books is the story of many of the industries themselves. The weaving industry in Kent, centred at Canterbury, appears to have been introduced in the Middle Ages by Flemish refugees and later reinforced by Huguenot weavers in the seventeenth century. The silk factories in Suffolk and Essex also come from Huguenot enterprise, and the woollen homespun industry in the Lake District was established by Flemings in the fourteenth century. Lace-making is also largely of Continental origin, although the names of the traditional patterns have become anglicized as appears in the well-known "Bedford," "Buckingham" and "Honiton" lace. The jet industry of Yorkshire goes back much further; the Phœnicians, it is said, were interested in Whitby jet, the mines which run inland from the face of the cliff having been worked by the early Britons as they are by the local people to-day, for the same purpose of getting the jet for carving into ornaments and making beads.

Volume IV, on Wales, will be especially interesting to rural workers in the Principality, and to those who, wisely, seek to develop the rural products of our numerous rural craftsmen. It is time that Rural Community Councils, with their helpful oversight of rural industries, became established in Wales. If, in some cases, the county is too small a division to support a Council, there may not be any great difficulty in getting a combination of counties, possibly with a centre in the provincial university, which could do much to assist the movement.

In a country like Wales, rural industries bulk more largely in the life of the people than they do in England; we would therefore expect them to be better developed. Already the woollen industry, with about 150 factories, has made its products widely known. Of these factories, nearly 100 still use water-power only, showing how important the quick-flowing mountain currents are in the generation of power for these enterprises. In addition to the factories, there are a number of individual handloom weavers who work near the spinning and fulling mills.

In the industries connected with the Welsh woodlands, the making of clogs appears to be one of the most important. There is also cooperage, or the making of all kinds of barrels and vats, wood turnery for chairs, tool handles, etc, hurdles, packing shavings and charcoal burning. Osiers, willows and rushes are also used in the making of baskets, lobster pots, the ancient coracles, mats, etc. Tanning, pottery and small handicrafts such as toy making, leather purses and bags, complete the list outside the work of the larger craftsmen such as the blacksmith, wheelwright and carpenter. These skilled trades in Wales, as in England, are in need of revival, to accomplish which assistance by local farmers and others living in the country is chiefly necessary. No country dweller should think of buying from the factory an article which can be quickly made in the local smithy or carpenter's shop. This applies to all forms of wrought iron work, from the larger farm implements to latches, knockers, bolts for doors, and other forms of ornamental wrought-iron work. All of it is very much better and more lasting than the products of the factory; the local blacksmith can often make them, only he is not asked for them, but kept mainly to the job of shoeing horses. The same sort of thing often occurs in the case of the carpenter and the saddler.

Generally, and to sum up, the four volumes on *The Rural Industries*

of England and Wales, giving as they do the results of a new and up-to-date investigation into actual conditions in the country, are of very considerable value indeed to inquirers of all degree, whether for business purposes, social reform and rural improvement purposes, or for the mere student; and they can, therefore, be confidently recommended to them all.

Modern Denmark. By Hugh Jones. pp. xii + 83. (London: P. S. King & Son, Ltd. Price 2s. 6d. net.)

This is the short story, well written, of the rise of Denmark from a condition of extreme poverty to its present position as one of the best cultivated and best organized agricultural countries in the world.

The author makes the inevitable comparison between this country and Denmark, to the disadvantage of the former, but he admits the difference in conditions. Agriculture is practically the only industry in Denmark, and in making a living from the land the Danes are assisted by a consistent State policy, the object of which is to ensure the highest degree of productivity from the land, and by the fact that the industry is organized for an export market.

According to the writer, however, "It is absurd to say that agricultural co-operation is ineffective outside export countries." Yet he is constrained to admit in another part of the book that "The (Danish) co-operative societies in the towns have attacked the problem of the elimination of the middleman and have found the problem almost insoluble."

When Mr. Jones comes to deal with "Land Culture and Production" he is responsible for at least one serious mistake. He says, "The experiments of the scientists have resulted in the discovery that—weight for weight—roots are more than twice as valuable as hay for feeding purposes and more than seven times as valuable as green feed." This bears the stamp of obvious error. It may suffice to say that, according to the leading Scandinavian authority -Hansson—hay is five times as valuable as turnips, and that of the ordinary foodstuffs turnips occupy the lowest position in the table of feeding values.

The final chapter, dealing with deductions and suggestions, is not very helpful. "From time to time," it is stated, "suggestions, sometimes plausible, sometimes hopelessly impracticable, are made. Safeguarding and Protection are often urged as providing the only remedies, but the ramifications of the industry at home are often lost sight of. Protection of one side of the industry would open the door to legitimate claims from a hundred and one other branches," etc. Yet the one concrete proposal the author makes is for a tax on imported meat!

The Science of Farm Labour: (1) Scientific Management in German Agriculture, *International Labour Review*, March, 1927; (2) An Investigation of Certain Processes and Conditions on Farms, by W. R. Dunlop, *The National Institute of Industrial Psychology*.

In recent times a certain amount of attention has been given to the possibility of applying the principles of "scientific management" to agriculture, and some research in this direction has been carried out, including motion studies, the study of fatigue, and the investigations concerned with the efficiency of manual labour. The first of the above documents gives a useful summary of work done on this subject in Germany, particularly at the experimental station at Pommritz. Here an attempt has been made to study scientifically the elimination of unproductive labour in agriculture, and the investigations have been conducted on a somewhat wider basis than has often been the case. Farm lay-out; the position of buildings in relation to the fields; and the shape of fields, have been carefully studied, as well as a great number of manual operations. The following are some examples of

experiments carried out: Comparison of the efficiency of ploughing with the driver riding and walking; methods of plaiting bands for sheaves; methods of gathering the sheaf and binding it in its own straw; loading potatoes, etc. In addition to these motion studies, the examination of different kinds of tools by similar analytical methods has been undertaken.

One of the most interesting branches of inquiry is the experiments on payment by results which have been carried out by the Association of Employers in agriculture and forestry in Silesia. These experiments, conducted on 44 farms, cover all kinds of work throughout the year. Elsewhere this method has also been investigated and various forms of premium and bonus have been tried, *e.g.*, a bonus for quality of work, for economy of raw material, for good upkeep of machinery and tools. In some cases good results have been obtained by payment of a "premium task wage," *i.e.*, a payment in addition to the regular time wages for a definite task performed. The form of such a premium naturally varies with the kind of work undertaken. In addition to these, studies of team work, gang work and individual work have been made, particularly at Pommritz.

In this country very little investigation of this kind has been undertaken, and Mr. Dunlop's study is, on this account, all the more welcome. The investigation is concerned chiefly with motion studies conducted on certain farms in Kent, and in connexion with the South Eastern Agricultural College at Wye. They include the picking of bush fruit and hops; packing strawberries, loganberries, etc.; picking, grading and packing glasshouse produce; and a series of experiments on milking. Full experimental results are published and full description is given of how the experiments were actually carried out. The results go to emphasize not only the possibilities of economy in human effort in agriculture, but also the special difficulties which have to be confronted in agriculture as compared with manufacturing industry, where the application of manual effort is usually more a matter of steady routine. One might, perhaps, be tempted to criticize some of the experimental conditions in which the investigations were made, and to question some of the conclusions. However this may be, the broad results of the experiments show—as is nearly always the case in investigations of this kind—that in the simple elementary movements by which manual work on the farm is carried out, there lies hidden a steady, persistent waste of human effort which enlightened management might eliminate, or at least materially reduce.

Guide to an Exhibition of Manuscripts and Printed Books illustrating the History of Agriculture. With eight plates. (Printed for the Trustees of the British Museum. Price 1s. On sale at the Museum.)

The exhibition to which this is a Guide has been arranged in the King's Library, British Museum, on the occasion of the Imperial Agricultural Research Conference. It illustrates the history of agriculture by means of specimens of: (1) Papyri from Ancient Egypt, in which illustrations of agricultural occupations occur; (2) Greek papyri illustrating agriculture in Egypt between 332 B.C. and A.D. 641; (3) mediæval and modern manuscripts of agricultural interest, ranging from the 12th to the 16th centuries; (4) printed books dealing with agriculture and husbandry, from the early part of the 16th century to the beginning of the 19th century.

Each item is exhaustively described (and, in the case of many of the manuscripts, transcribed) in the Guide, which is illustrated with four plates of reproductions of manuscripts and four of woodcuts and engravings in printed books.

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NOTES FOR THE MONTH

Winter Feeding of Dairy Cows

At pp. 720 and 723 of this issue will be found two short articles by well-known experts on the winter feeding of dairy cows. One is written from the standpoint of the grassland farmer who, for the bulky part of the ration, depends almost entirely on hay; the other from the standpoint of the "mixed" farmer who, in the ordinary course, grows corn for sale and cultivates roots as one of his rotational crops.

Owing to the abnormal season hay, generally, is of inferior quality. Mr. Boutflour suggests that the best hay should be spun out with a greater quantity of the second-rate quality, and that really bad hay should not be fed at all: instead the farmer must "purchase (*a*) hay, or (*b*) straw, and sugar beet pulp or roots."

Both writers make the point that the heaviest milkers should have first call on the better qualities of hay available.

The "mixed" farmer has probably been able to secure a portion of his "seeds-hay" before the weather broke. In general he is well supplied with roots. He has also at hand considerable supplies of straw suitable, at least, for picking over, and, it may be, considerable quantities of damaged grain. Mr. W. A. Stewart suggests how this can best be blended for milk production.

* * * * * *

The Young Farmers' Clubs Movement

It will be remembered that about three years ago the Ministry took over the control of the Young Farmers' Clubs Movement in this country, and appointed an officer to foster the formation of clubs and, generally, to supervise and establish the Movement in rural districts. At that time, there existed 13 clubs with a total membership of about 260, distributed over eight counties.

During the intervening period, considerable progress has been made, and there are now 130 clubs, organized on progressive lines, with over 3,000 members in 23 counties.

Of these clubs, 72 specialize in poultry-rearing; 35 deal with "mixed" stock, *i.e.*, any individual club may work with poultry and rabbits, with poultry and horticulture, with rabbits and calves, or may even combine all these interests; 16 are devoted to rearing calves; three are bee clubs; three tend rabbits; and one devotes its whole activities to horticulture.

Six calf clubs had entered for the annual dairy cattle judging competition, which was to have been held at the Dairy Show last month (October). Unfortunately the exclusion of cattle from the Show, on account of the outbreak of foot-and-mouth disease near London, rendered a postponement necessary. The clubs compete for a silver challenge cup, presented by the proprietors of *The Farmer and Stockbreeder and Agricultural Gazette*, and silver and bronze medals given by the British Dairy Farmers' Association. Last year the cup was won by the Sussex Baby Beef Club.

A brief summary of the development of the movement in the four northern counties, Northumberland, Cumberland, Westmorland and Lancashire, shows that it has progressed most rapidly in the first two counties, which now have five and seven clubs respectively. Of the Cumberland clubs, five are working with poultry (one or two with rabbits also), and two with calves, and it is worthy of note that most of these clubs have been promoted by schoolmasters in connexion with rural schools. A leader of one of these clubs, in sending an account of the first meeting, observes that the club is "moving slowly but surely, as funds are very difficult to accumulate," this being typical of the movement in the north. The clubs are receiving practical aid in Cumberland, the Governors of the Cumberland and Westmorland Farm School having agreed to allow short credit to club members in respect of sittings of eggs and of small live stock supplied.

Of the Northumberland clubs, three have held their annual show and sale of stock during recent months. A report concerning one of these clubs says: "The Slaley Club held its first Show and Sale during August last at the Annual Show of the Slaley and District Horticultural and Agricultural Society. Fifteen heifer calves, all about a year old, were exhibited, and the quality and condition of the animals fully merited the praise accorded by a large gathering of visitors. The calves were subsequently sold by auction, the average

price realized being £14 17s. 6d., the best animal bringing in £18. The club members profited to the extent of £3 to £4 on the sale." The members of this particular club also proved themselves, recently, to be good judges of dairy cattle, obtaining only twelve fewer points than the American Young Farmers' Clubs' International Team in a cattle-judging contest held in Northumberland. This is regarded as a most meritorious performance, and the Slaley Club is to be congratulated upon the result.

* * * * * *

Pickling Wheat

FOR the prevention of bunt or stinking smut in wheat, farmers are now being recommended to try dusting the grain with copper carbonate instead of moistening it with solutions of copper sulphate or formalin. (See Ministry's Leaflet No. 92, 1925 edition.)

Dusting with copper carbonate has certain advantages :—

(1) It does not injure germination ; in fact, there is some evidence to show that the braird from treated seed is better than that from untreated.

(2) Treated seed may be stored, if necessary, without injury ; wet methods do not permit this.

(3) Dusted seed does not involve alteration of the seed drill to compensate for swelling, as is sometimes necessary with the wet methods.

The best control is given by samples of copper carbonate containing about 50 per cent. of copper, and of a fineness represented by about 90 per cent. passing through a 200-mesh sieve. The powder should be used at the rate of 2 oz. per bushel.

As to the method of applying the dust, it is essential that it should cover all parts of the grain, particularly the "crease" and the "brush," in which spores often lurk. Mixing, therefore, must be thorough. For this purpose machines of the rotary type are best. On the farm a suitable mixer may be made by fitting an axle and crank of, say, gas piping to a barrel supported on a stand. The barrel should not be more than half full of seed, and preferably only one-third full. One or two wooden baffle plates, fixed longitudinally inside the barrel, will help considerably to ensure that the grain becomes thoroughly and evenly coated with the powder. Other means of mixing will suggest themselves, but mixing on a floor is not satisfactory. For one thing, inhaled dust is most objectionable, and may cause severe nausea and irritation. It is advisable to mix in the open and to keep to the windward. A dust mask or a wet handkerchief should be worn over the nose and mouth while the grain is being treated.

It is understood that copper carbonate of the grade and quality referred to costs about 75s. per cwt. Cheaper forms containing less copper are available, and these, if equally finely ground and used at a correspondingly higher rate, are likewise believed to be effective.

If more seed is treated than is used for sowing, the surplus should not be used for feeding purposes, as copper salts are poisonous. Further, such seed should not be allowed to stand in the seed drill under moist conditions, nor should dust be allowed to accumulate in the machinery on account of the risk of injuring the drill.

Where the seed grain is only slightly contaminated with bunt spores, pickling with copper carbonate dust may be expected to give as effective protection from the disease as that obtained with the wet formalin and bluestone (copper sulphate) pickles; but with severely contaminated grain the wet methods have proved to be more effective than the dry powder. Heavily smutted (blackened) seed, however, should not be sown.

* * * * * *

Demonstrations in Marketing Home Produce

FRESH ground has been broken during the last two months by the staging of the Ministry's Marketing Demonstrations at market towns in the West of England. At the end of September the marketing of eggs and poultry was demonstrated at the Market Hall, Shrewsbury, to an audience which was undoubtedly appreciative.

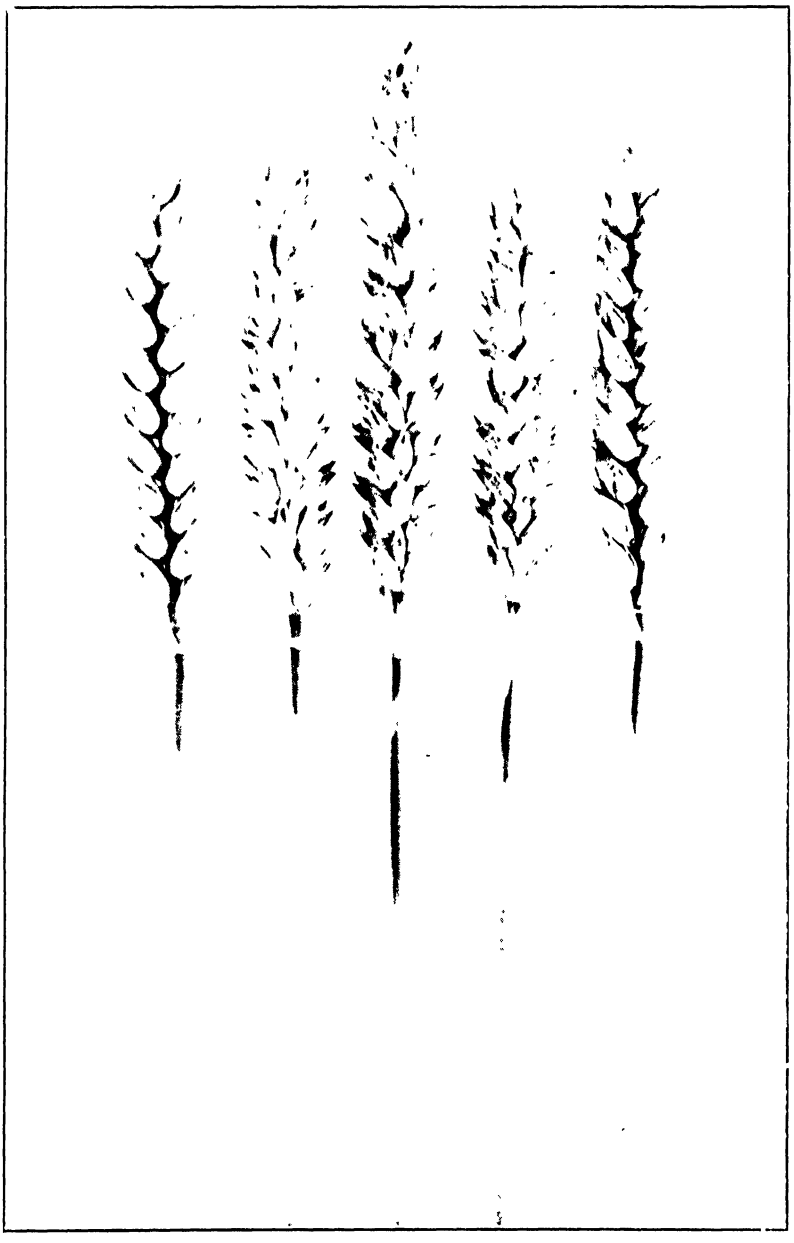
Simultaneously, the fruit section began at Hereford a short tour which, by way of Pershore and Grange Court Markets, is finishing up at the Imperial Fruit Show. At each of the first three markets, the demonstrators were busy grading and packing apples supplied for the purpose by growers in the several localities, the best of the fruit being boxed and sent to distant markets, bearing on the boxes the national label suggested in the report on fruit marketing. It is not to be expected that a grower will benefit financially immediately he undertakes grading and box-packing, and therefore it was interesting to find that, as a matter of fact, fruit graded and packed at these demonstrations and sold at once on the auction floor did make a better price than similar ungraded fruit, even though most of the latter was also sold in non-returnables.

At the Imperial Fruit Show, the Cutler Grader has been operated with apples purchased " as picked," and growers and salesmen must have been interested to see how this fruit graded out.

Grading home-grown apples with the Culter Grader.

Boxes of graded home-grown apples.

To face page 602.



"Brown Neck" in Wheat.

"Brown Neck" in Wheat

Several inquiries have been received, during the past summer, at the Ministry's Plant Pathological Laboratory, Harpenden, concerning a brown discoloration or stain which occurs at the top of the wheat haulm, usually just beneath the ear, as shown in the illustration opposite. The browning begins whilst the haulm is still green, and generally extends for about an inch or so below the ear. At first it is not particularly striking, but as the haulm ripens and becomes yellow, the contrast in colour becomes increased, so that "Brown Neck," as it may be called, is sometimes very evident. The discoloration is due mainly to the death of certain groups of cells containing the green colouring matter known as chlorophyll, which are towards the margins of the haulm: but the cause of death of these cells is not known. There appears, however, to be no interference whatever with the sap-conducting channels of the haulm, and the ears ripen normally. Moreover, the supporting tissues of the haulm do not become weakened and the straw does not break at the neck. "Brown Neck" was first observed many years ago, but it appears to have become increasingly prevalent during recent seasons. It is not confined to any one variety. In view of the fact that no apparent harm accrues to the crop from the presence of this discoloration, farmers need feel no great alarm about it.

* * * * * *

The Black Currant Gall Mite on Red Currants

The following note has been communicated to the Ministry by Mr. A. M. Massee, of the East Malling Research Station :—

The Black Currant Gall Mite (*Eriophyes ribis* Westw.; Nal.) has been recorded on red currants for a number of years, but until recently it does not appear to have affected the cropping of the bushes to any marked extent, and in consequence has been overlooked by growers in many instances.

This pest, however, has become far more common during the past three years, and in many cases has been recorded as being a serious pest of red currants. At the present time it is very common in red currant plantations in many districts in Kent, including Canterbury, Brenchley, and Maidstone.

Description of the Disease.—The gall mite does not produce on red currants the "big-buds" which are so common on black

currants, but in instances of severe infestation the buds tend to swell out considerably, especially those at the base of the bush. The enlarged buds can be detected from November to March or April. About the middle of April the mites migrate from the buds and live freely on the leaves, and the infested buds eventually dry out. Probably the best time to detect the presence of the mites is in the spring as soon as the buds begin to open. At this season it will be noticed that the majority of the mite-infested buds remain dormant. These dormant buds are referred to frequently as "blind" buds, and are said to be the result of bird attack during the winter months.

Varieties Attacked.—Raby Castle undoubtedly suffers most from the attacks of the mite; other varieties, such as Fay's Prolific, are attacked in a lesser degree.

It might be as well to point out that white currants and gooseberries are attacked in a similar manner, and, as in the case of red currants, the disease is on the increase in many localities.

* * * * * *

International Institute of Agriculture

THE Institute has recently published the *International Year Book of Agricultural Statistics*, 1926-27. The general make-up of the volume is similar to that of earlier years, while the information has been amplified in some directions, *e.g.*, by the inclusion of statistics of international trade in wine, sugar and silk, and of tables relating to the approximate consumption of various descriptions of fertilizers in certain countries. The volume is divided into nine sections, the first dealing with total area and population, and the second with the apportionment of the area, the agricultural production and the numbers of live stock in each of a number of countries. Sections III and IV are devoted to the production of the principal crops, and the numbers of each of the principal descriptions of live stock throughout the world (as far as figures are available). The remaining five sections deal with international trade, prices, ocean rates of freight, fertilizers (production, trade, consumption and prices), and rates of exchange.

Copies of the Year Book, which contains a large amount of statistical data of great value to the student of international agricultural statistics, may be purchased from the Ministry (price £1 paper, £1 2s. 0d. cloth).

Permanent Committee on Basic Slag

THE fifth Interim Report of the Permanent Committee on Basic Slag, just issued, covers experiments carried out on behalf of the Committee during 1925 and 1926, and gives the conclusions which the Committee feels justified in drawing from the results of their experiments so far as these have gone. The Report includes statistics of production, disposal, imports and exports of basic slag, and of the estimated quantities of superphosphate and phosphate rock used in agriculture in Great Britain. An account is also given of the Agricultural Education Association's phosphatic field trials, 1921-24.

The article by Sir John Russell, detailing experiments carried out at Rothamsted with basic slag during these years (see page 727 of this issue) summarizes the results of the experiments and outlines the conclusions set out in the Report.

Copies of the Report can be obtained on application to the Ministry, 10 Whitehall Place, London, S.W. 1.

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Poultry Instructors' Conference, 1927

THE Sixth Annual Conference of County and College Poultry Instructors was held on October 18, at the offices of the Ministry of Health, the Poultry Commissioner occupying the chair. Seventy-six instructors, agricultural organizers, principals of colleges and others were present, including fourteen representatives from Welsh counties. The proceedings were opened by Sir C. Howell Thomas, Secretary to the Ministry of Agriculture and Fisheries, who referred to the gratifying extension of the industry which had taken place in recent years. They had now in England and Wales some ten million more adult birds than in 1913, and the number was increasing at the rate of approximately 1½ millions per annum; but the fact that they still imported eggs and poultry to the annual value of over £20,000,000 revealed the need for further and fuller instruction in scientific methods of production and marketing. Miss M. P. Bally gave an account of the Egg-Laying Trials in Pembroke, which was followed by a paper from Mr. E. Rea on the vexed question of "Uniformity in County Egg-Laying Trials." As a result of the ensuing discussion, a committee was appointed, under the chairmanship of Major C. H. Eden, with a view to the formulation of a common system of scoring. Mr. T. W. Palmer gave an interesting address on "Goat-keeping in conjunction with Poultry," Mr. E. Russell described the non-subsidized Egg Distribution Scheme in Devon, and Mr. F. Bowers followed with an account

of the operation of the non-subsidized section of the Scheme in Essex. In view of the fact that grant-aided schemes are now to be discontinued, much interest was aroused by these papers. Mr. B. C. Brewer spoke on "Methods of Poultry Instruction in Somerset"; Mr. G. W. Goode on "Methods of Marketing Eggs and Poultry in Yorkshire"; Miss E. Kidd on "Small Live Stock Work in Surrey"; and Mr. L. G. Price on "Poultry-keeping on general farms."

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Dairy Instructors' Conference, 1927

THE Fourth Annual Conference of County and College Dairy Instructors and Instructresses in England and Wales, convened by the Ministry, was held on October 20, at the Offices of the Ministry of Labour, Montague House, Whitehall. The Conference met under the chairmanship of Mr. J. F. Blackshaw, O.B.E., the Ministry's Dairy Commissioner. In addition to County and College Instructors and Instructresses, there were present a number of Agricultural Organizers and Principals of Agricultural Colleges. Including the Ministry's officers, the attendance was, approximately, 130.

The Conference was opened by the Minister of Agriculture and Fisheries. Mr. Guinness referred to the efficient work which was being done in Dairy Education, and said that, partly as a result of this work, the dairy farming industry in this country had achieved a position which, he thought, was second to that of no other country. Remarkable co-operation existed between the Local Health and Educational Authorities and farmers, and the next step was to obtain the sympathy and support of the trade and of the public.

Addresses were given on the following subjects :—

"Milkers' Competitions in Conjunction with Clean Milk Competitions," by Mr. J. H. Mattinson, B.Sc., Agricultural Organizer for Surrey.

"The Milk Trade and Clean Milk Production," by Sir William Price, United Dairies, Limited. The paper was read by Mr. Tudor Price.

"Progress of Arrangements for the World's Dairy Congress," by Mr. V. E. Wilkins, Ministry of Agriculture and Fisheries.

"The Efficient Use of Milking Machines," by Mr. A. T. R. Mattick, B.Sc., National Institute for Research in Dairying, Reading.

"Some Economic Aspects of Milk Production," by Mr. James Wyllie, B.Sc., N.D.A. (Hons.), N.D.D., South-Eastern Agricultural College, Wye.

"Mammary Infections and their Bearing on Clean Milk Production," by Mr. A. W. Holtum, M.R.C.V.S., B.V.Sc., D.V.H., of the Ministry's Veterinary Laboratory. This was followed by an address by Mr. J. C. W. Simms, B.Sc., N.D.D., Instructor in Dairying for West Sussex, who gave a brief account of his experiences in connexion with mastitis.

All the addresses were followed by valuable open discussions.

THE NUTRITIVE VALUE OF SWEDES, MARROW STEM KALE AND SUGAR BEET TOPS

T. B. WOOD, C.B.E., LL.D., F.I.C., F.R.S.,
Draper's Professor of Agriculture and Director of the Animal Nutrition Research Institute, Cambridge University.

IT is commonly asserted and widely believed that swedes grown in different districts vary greatly in nutritive value; that, for instance, swedes grown in certain districts in Norfolk and in the East of Scotland are very much more valuable than swedes of the same variety grown in the Cambridgeshire or Isle of Ely Fens. The point is one of considerable practical and scientific interest. It has been studied by the method of chemical analysis by Collins,* and by the writer and R. A. Berry, with results so indefinite that they were not published.

A series of sheep-feeding trials, carried out conjointly by the Cambridge Animal Nutrition Institute and the Norfolk Agricultural Station at Sidney Farm, Saxlingham, Holt, Norfolk, of which the writer has control, has fortunately provided material from which, by appropriate methods, can be worked out the real nutritive values not only of two widely different samples of swedes, but also of marrow stem kale and sugar beet tops.

Before proceeding further, it is obviously necessary to define what is understood by the term nutritive value. In the writer's opinion, which is backed by many years of experience in the conduct and interpretation of feeding trials, far the best measure of nutritive value is Kellner's starch equivalent, and the following calculations are accordingly concerned with the estimation of the starch equivalent of two samples of swedes, of marrow stem kale, and of sugar beet tops.

Estimating Starch Equivalent.—Kellner's original method of estimating the starch equivalent of a feeding stuff is well known and need not be described. It involves the use of a respiration chamber by means of which a complete carbon and nitrogen balance experiment can be carried out, and for this reason is beyond the scope of the ordinary experimenter. Kellner starch equivalents can, however, be estimated from an ordinary digestibility determination, provided a suitable

* *Jour. Agric. Sci.*, Vol. I, 1906, p. 89.

value number can be assumed, and this method has been frequently used. The ordinary experimenter, however, does not possess even the apparatus required for a digestibility determination, and this method, too, is therefore beyond his scope.

There is still a third method—to the writer's knowledge, unused heretofore—which is within the scope of any experimenter, and is capable of yielding accurate results of great practical value. This method and the results which it has given are described below.

The essence of this method is that when it is expressed in starch equivalent the average ration consumed by any lot of animals is equal to the average maintenance requirement plus the average gain in live weight multiplied by the weight of starch equivalent required to make 1 lb. gain in live weight. This is perhaps easier to follow if put in the form of a simple equation, thus :—

R = average ration per head per week in lb. starch equivalent.
M = average maintenance requirement in lb. starch equivalent.
G = average live weight increase per head per week in lb.
K = weight in lb. of starch equivalent required to make 1 lb. of live weight increase.

Then $R = M + G K$.

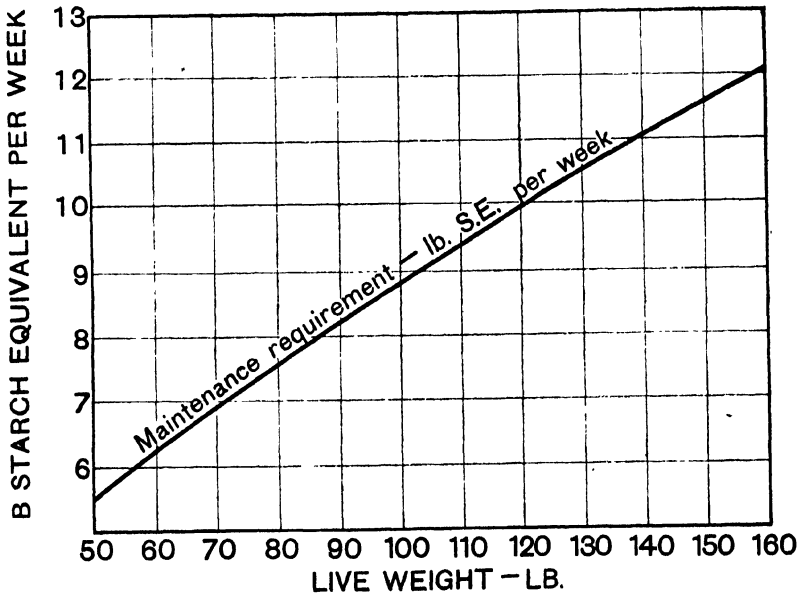

FIG. 1. Maintenance requirement of fattening Sheep.

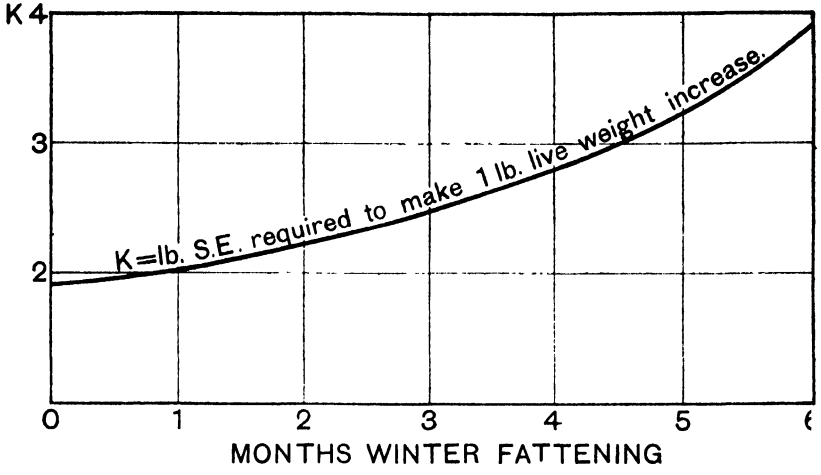

FIG. 2. Production requirement of fattening Sheep.

This equation has been found to be justified, provided the animals are quiet and contented so that they do not waste undue amounts of starch equivalent in movement.*

R can be readily calculated from the constituents of the ration.

M can be read off from the curve given in Fig. 1, which is based on the work of Capstick and Wood,† taking the average live weight of the animals during the experimental period.

G is calculated from the periodical weighings made during the course of the experiment.

K can be read off from the curve in Fig. 2 based on the work of the writer,† taking the value at the middle of the experimental period.

The experimental data required and the method of using them to calculate starch equivalents are shown below. The data are taken from the Saxlingham experiments already referred to,‡ which need no further description.

Starch Equivalent of Norfolk Swedes.—*Experimental data :—*

Average live weight of animals during experimental period = 102 lb., therefore M = 8·9 lb. S.E. per week.

Average ration per week during experimental period :—

Norfolk swedes	.. ..	145 lb. = 1·45 × x lb. S.E. if x = S.E. in 100 lb.

* "Production Requirement of Fattening Sheep." This JOURNAL, July, 1927, p. 295.

† *Jour. Agric. Sci.*, Vol. XVI, ii, 1926, p. 325.

‡ "Production Requirement of Fattening Sheep." This JOURNAL, July, 1927, p. 295.

Hay, good seeds	.. ..	6·2 lb. = 2·5 lb. S.E.
Decorticated cotton cake	..	1·5 lb. = 1·1 lb. S.E.
Crushed barley	.. ..	3·0 lb. = 2·1 lb. S.E.

Therefore $R = 5{\cdot}7 + 1{\cdot}45\,x$ lb. S.E. per week.

The experimental period covered the first $3\frac{1}{2}$ months of winter fattening. The middle point of this period is $1\frac{3}{4}$ months, at which date K = 2·15 lb. S.E. per lb. gain. Average gain in live weight per week, $G = 2{\cdot}45 \pm {\cdot}04$ lb.

Then, $R = M + G\,K$.

$5{\cdot}7 + 1{\cdot}45\,x = 8{\cdot}9 + 2{\cdot}45 \times 2{\cdot}15$

$1{\cdot}45\,x = 8{\cdot}47$

$x = 5{\cdot}84$ lb. S.E. per 100 lb. swedes

Kellner's figure for starch equivalent per 100 lb. of swedes is 7·3 for average swedes containing 11·5 per cent. dry matter. These swedes contained 9·4 per cent. dry matter, which, if the dry matter bears a constant ratio to the starch equivalent, corresponds to $7{\cdot}3 \times \frac{9{\cdot}4}{11{\cdot}5} = 5{\cdot}95$ lb. S.E. per 100 lb. swedes, showing a satisfactory agreement between the results of experiment and calculation.

Starch Equivalent of Fen Swedes.—For the purpose of this experiment, five acres of swedes of the same variety as those grown at Saxlingham were grown in Littleport Fen by Mr. Martin, the same delivery of seed being divided between the two places. They were sent by rail to Saxlingham, heaped on a barley stubble on which a similar number of sheep (50) were folded, their ration being the same weight of hay and concentrates as was given to the 50 sheep on Norfolk swedes, and all the cut Fen swedes they would eat. The actual weight of swedes consumed was 155 lb. per head per week.

Experimental data :—

Average live weight during experimental period, 98 lb.
Therefore M = 8·7 lb. S.E. per week.

Average ration per head per week during experimental period :—
Fen swedes, 155 lb. = $1{\cdot}55\,x$ lb. S.E., if x = S.E. in 100 lb.
Hay, cake and barley as before = 5·7 lb. S.E. per head per week.

Production requirement as before, 2·15 lb. S.E. per lb. gain.

Average gain in live weight per head per week,
$G = 2{\cdot}31 \pm {\cdot}05$ lb.

Then, $R = M + G\,K$

$5{\cdot}7 + 1{\cdot}55\,x = 8{\cdot}7 + 2{\cdot}31 \times 2{\cdot}15$

$1{\cdot}55\,x = 7{\cdot}97$

$x = 5{\cdot}15$ lb. S.E. per 100 lb. swedes.

Analyses of samples of these Fen swedes gave the average percentage of dry matter=8·1. Assuming, as before, that the starch equivalent is proportional to the dry matter, the Kellner starch equivalent of these swedes should be $7{\cdot}3 \times \frac{8{\cdot}1}{11{\cdot}5} =$ 5·14 lb. S.E. per 100 lb. swedes. The agreement between the experimental figure and that calculated from the figure given by Kellner is almost too good.

The following table shows Kellner's figure, and the above two experimental figures for the starch equivalent of swedes as percentage of the dry matter :—

	Dry matter per cent.	Starch equivalent per cent.	Starch equivalent as percentage of dry matter
Kellner's figures ..	11·5	7·30	63·5
Norfolk swedes ..	9·4	5·84	62·1
Fen swedes ..	8·1	5·15	63·6

From these figures it is, in the writer's opinion, fair to conclude that the difference in the nutritive value of swedes grown in different districts is entirely accounted for by their variation in content of dry matter. The method of investigation proved very satisfactory, and might profitably be used to study the nutritive value of swedes grown in other districts, of varieties of swedes grown side by side and differing in dry matter content, and of other crops which are commonly used for folding sheep in the winter. The one considerable difficulty which it involves is the accurate estimation of the weight of roots or green fodder actually consumed.

It is, perhaps, noteworthy that the sheep under exactly similar conditions made rather smaller increases on Fen swedes than on Norfolk swedes, and one may well seek for an explanation of this. The Fen swedes had a considerable journey by rail and lorry, and had been out of the ground some time before they were sliced for the sheep. The Norfolk swedes were eaten quite fresh. Presumably for this reason the sheep found the Norfolk swedes rather more palatable, and consequently ate rather more in proportion to their dry matter content. The actual weights of dry matter consumed per head per week were : sheep on Norfolk swedes, 22·9 lb. (swedes 13·7) ; sheep on Fen swedes, 21·8 lb. (swedes 12·6). The writer has no doubt that this is the explanation of the lower rate of increase of the sheep fed on Fen swedes. The samples of Fen swedes for analysis were taken from the heaps which were being sliced for the sheep. Some evaporation

had probably taken place since the swedes were pulled. It is, therefore, likely that samples takes at Littleport would have contained even less than 8·1 per cent. of dry matter.

Starch Equivalent of Marrow Stem Kale.—It was suggested above that this method of estimating starch equivalent might be used for studying the nutritive value of other crops on which sheep are folded in the winter. Such a crop is marrow stem kale, which, on account of its great power of resisting drought on light land, is coming into continually increasing prominence. Kellner gives no figures for marrow stem kale, which was not known in his time. The figures given in *Rations for Live Stock*,* namely, 14·3 per cent. of dry matter and 8·9 per cent. of starch equivalent, were worked out, according to Kellner's formula, by the writer and Halnan from a small number of analyses and assumed digestibility co-efficients. For so important a crop they stand in urgent need of revision.

Accordingly, a third lot of 50 sheep were folded on marrow stem kale at Saxlingham in 1925-26, side by side with the two lots on Norfolk and Fen swedes. Numerous attempts were made to estimate the actual weight of kale consumed by the sheep. The methods tried were all based on weighing the crop on several small areas, averaging the weights, and calculating, from the average, the weight of kale on a fold of known area which the sheep cleared in a known time. The results, however, were entirely unsatisfactory. They indicated a rate of consumption far in excess of the possible appetite of the sheep, and at the same time it was noticeable that the sheep rejected considerable quantities of the harder parts of the stems and the older leaves. Attempts were also made to estimate the weight of the stems and leaves rejected, but with no success. Rejected leaves, especially, were so much contaminated with soil and water that their weight would have been meaningless. Such attempts as were made indicated a maximum figure of about 24 lb. of kale per day, from which an unknown but considerable weight of rejected leaves and stems must be subtracted.

The sheep evidently found the kale very palatable, and on this account it was decided that they would probably eat enough to supply them with the same weight of dry matter as was contained in the weight of Norfolk swedes eaten by the sheep folded alongside them. This was 145 lb. per head

* Ministry of Agriculture and Fisheries, Miscellaneous Publications, No. 32, Price 6d. net, post free.

per week of Norfolk swedes containing 9·4 per cent. of dry matter, *i.e.*, 13·6 lb. of dry matter. Analyses of three samples of the kale, taken at intervals during the experiment, gave 88·81, 88·68, 88·64, average 88·7, per cent. of water, corresponding to 11·3 per cent. of dry matter. Consequently 120 lb. would be required to provide 13·6 lb. of dry matter, the weight of dry matter consumed per head per week in the form of Norfolk swedes.

This consumption of kale is $120 \div 7 = 17$ lb. per head per day. If this is correct something like $24 - 17 = 7$ lb. per head per day, or nearly 30 per cent. of the crop, must have been rejected, a figure which agrees as well as could be expected with the very rough estimates made of rejected leaves and stalks. It seems reasonable, therefore, to assume that the average consumption of kale was approximately 120 lb. per head per week. The following data are based on this figure.

Experimental data :—

Average live weight during experimental period, 103 lb.
Therefore, M = 9·0 lb. S.E. per head per week.
Average ration per head per week during experimental period :—
Marrow stem kale 120 lb. = 1·20 x lb. S.E., if x = S.E. in 100 lb.
Hay, cake and barley, as before = 5·7 lb. S.E. per head per week.
Production requirement as before 2·15 lb. S.E. per lb. gain
Average gain in live weight per head per week,
G = 2·45 + ·05 lb.
Then, $R = M + G\,K$

$$5{\cdot}7 + 1{\cdot}20\,x = 9{\cdot}0 + 2{\cdot}45 \times 2{\cdot}15$$
$$1{\cdot}20\,x = 8{\cdot}57$$
$$x = 7{\cdot}14 \text{ lb. S.E. in 100 lb. kale}$$

This corresponds to $7{\cdot}14 \times 100 \div 11{\cdot}3 = 63{\cdot}2$ per cent. of starch equivalent in the dry matter. The figures given in *Rations for Live Stock* correspond to $8{\cdot}9 \times 100 \div 14{\cdot}3 = 62{\cdot}2$ per cent., a sufficiently satisfactory agreement to confirm both figures. It also serves to suggest that, for swedes and other succulent crops grown for folding, the starch equivalent is approximately 62 to 63 per cent. of the dry matter.

The Starch Equivalent of Sugar Beet Tops and Crowns.—Sugar beet culture is extending rapidly, and its extension is likely to continue, at any rate whilst the home-grown sugar subsidy remains at anything like its present figure. Tops and crowns form so large a proportion—somewhere in the neighbourhood of one-third—of the total crop, that an estimate of their real nutritive value is very desirable. The writer, in *Rations for Live Stock*, gives the average percentage of dry matter in tops and crowns as 19·5 per cent., and the starch equivalent per 100 lb., estimated by Kellner's formula,

as 9·1. These figures were based on Kellner's digestibility co-efficients applied to a small number of analyses of English-grown produce before the War. Kellner, from his own investigations, gives 16·2 and 7·5 as the average percentages of dry matter and starch equivalent found. Recent, and as yet unpublished, analyses and digestibility determinations, carried out at Cambridge, confirm Kellner's figure for the average percentage of dry matter, but indicate that the percentage of starch equivalent is as high as 8·5.

In view of the importance of encouraging the proper use of sugar beet tops and crowns it was decided to attempt to estimate their starch equivalent by the sheep folding method. For this purpose 120 sheep were folded at Saxlingham during the autumn of 1926, half of them on swedes and half on sugar beet tops and crowns grown alongside. During the experimental period of 45 days, beginning on November 15, the sheep got per head per week 5 lb. of good seeds hay chaff, 1·64 lb. of crushed barley, and 0·82 lb. decorticated cotton cake meal. Those on the sugar beet tops and crowns were kept in their fold until they had cleared it up to the greatest extent which was possible. Many leaves were, however, trampled into the soil and rejected, and some of the crowns were also left, presumably those which through having gone to seed were hard and woody. If they had cleared up completely, their maximum consumption of tops and crowns estimated, as in the case of the kale, by weighing tops and crowns on several small areas, would have been 142 lb. per head per week. The large proportion rejected showed that actual consumption did not reach anything like this figure. Weighing the rejected portions was useless. They were too heavily contaminated with soil and water. It was, therefore, necessary to fall back on the unsatisfactory expedient of estimating the consumption by assuming that the sheep ate that quantity which would make the dry matter of their total ration up to 22 lb. per head per week, the average dry matter consumption of sheep of their live weight as recorded in preceding experiments at Saxlingham.

The Saxlingham tops and crowns contained on the average 16·2 per cent. of dry matter. The hay, barley and cake eaten by the sheep contained 6·5 lb. of dry matter per head per week. They should have eaten, therefore, $22 - 6{\cdot}5 = 15{\cdot}5$ of dry matter as tops and crowns, which corresponds to $15{\cdot}5 \times 100 \div 16{\cdot}2 =$ 93 lb. of tops and crowns. If this is correct they must have rejected about one-third of the tops and crowns left on the

land, or much the same proportion as was estimated to have been rejected in the case of the marrow stem kale.

Experimental data :—

Average live weight during experimental period, 96 lb.
Therefore, M = 8·6 lb. S.E. per head per week.
Average ration per head per week during experimental period :—

Sugar beet tops and crowns ..	93 lb.	= ·93 x if x = S.E. per 100 lb.
Seeds, hay, chaff	5 lb.	= 2·00 lb. S.E.
Crushed barley	1·64 lb.	= 1·10 lb. S.E.
Decorticated cotton cake meal	·82 lb.	= ·56 lb. S.E.

Production requirement at middle day of first 1½ months, K = 2 lb. S.E. per lb. live weight increase.
Average gain in live weight per head per week, G = 1.63 lb.
Then, R = M + G K

$$\cdot 93\,x + 2\cdot 00 + 1\cdot 10 + \cdot 56 = 8\cdot 6 + 2 \times 1\cdot 63$$
$$\cdot 93\,x = 8\cdot 2$$
$$x = 8\cdot 8 \text{ lb. S.E. per 100 lb. tops and crowns.}$$

This figure is slightly higher than a recent estimate made at Cambridge on the basis of Kellner's formula applied to average composition and recently determined digestibility coefficients. It indicates that the starch equivalent is only 54 per cent. of the dry matter, a much lower proportion than that found in swedes and kale. The estimate of the actual consumption of tops and crowns was, however, so unsatisfactory that the writer has only described the experiment as an example of this method of estimating starch equivalent, showing the main difficulty in using the method in the case of green crops folded on the land, namely the difficulty of estimating the actual weight consumed.

Summary.—(1) A description is given of a method of estimating the starch equivalent of feeding stuffs. It can only be applied to such feeding stuffs as can make up the greater part of a ration.

(2) The method involves nothing more than a carefully conducted feeding trial which must be so arranged that the feeding stuff on trial forms the greater part of the ration.

(3) The starch equivalent of two samples of swedes have been estimated and shown to be in each case very nearly 63 per cent. of the dry matter, from which it is argued that swedes from different districts only differ in nutritive value in proportion to their dry matter content.

(4) The method has also been used to estimate the starch equivalent of marrow stem kale and sugar beet tops and crowns, but, on account of the great difficulty of estimating correctly the actual weight of these fodders consumed by the sheep, the results must be regarded as of a tentative character only.

ACCESSORY FOODSTUFFS FOR USE WITH CEREALS IN PIG FEEDING

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CEREAL meals (milling offals, barley and maize meals) have always figured largely in the feeding of the pig, and, even with the wealth of feeding stuffs open to our choice to-day, few rations are compounded which do not include a large proportion of this class of food. It has always been recognized, however, that a diet of cereal meals, alone, does not produce entirely satisfactory results, and that, in particular, an addition of separated milk or whey to the cereal diet effects a very marked improvement.

So marked indeed is the improvement that, in wide circles of farmers, the idea at one time became prevalent that profitable pig feeding could not be carried on as a regular part of farm routine except in immediate association with dairying. Only when bacon prices were high and the cost of feeding stuffs low, did the non-dairy farmer concern himself much with pig feeding, and the irregularity of his pig-feeding activities contributed, as it still does, to create the familiar instability of the pig market, with its regular cycles of high and low prices and supplies.

The deficiencies of the cereal meals presented a less serious problem in the days when the pig could be grown slowly as a "store," and finished off separately at a year old or more as a large fat bacon pig, than they do to-day when the main demand is for a comparatively small and lean bacon pig, and consequently all our effort needs to be directed towards growing and fattening the pig simultaneously in the shortest possible time.

These deficiencies show themselves mainly in the rate of growth of the pig, as distinct from fattening, and once the greater part of the growth has been secured, the subsequent fattening can be effected quite satisfactorily on a diet of cereal meals alone.

The question to be answered, therefore, is: What supplements to cereal meals are necessary in order to ensure a satisfactory rate of growth? We have already alluded to the great advantage derived from a supplement of separated milk and whey. This may be illustrated by the results of a comparison made with lots of 10 pigs each, in an experiment carried out at the Harper Adams College in 1923, as summarized below :—

	Average live weight gain per day lb.
Cereals alone (average of 3 lots)	0·75
Cereals + bean meal (25 per cent.)	0·83
Cereals + pea meal (25 per cent.)	1·03
Cereals + separated milk	1·53
Cereals + whey	1·46

The addition of bean meal or pea meal to the cereal diet produced a certain amount of improvement, but far short of that given by milk or whey. The value of other supplements will be discussed below, but it may be admitted at once that no meal supplement has yet been devised which produces results quite equal to those obtainable with separated milk, although the gap is being steadily reduced.

In examining the composition of separated milk to obtain guidance as to possible causes of the improvement it effects, three items may be noted from which possible advantage may accrue, *viz.*, its richness in proteins, soluble mineral matters, and vitamins.

The Protein Factor.—With regard to proteins, we have good reason to believe that the proteins of cereals and cereal meals are inadequate, from the point of view both of quantity and of quality, for the needs of the growing pig. Generally speaking, one would wish to have not less than 20 per cent. of protein (say 15 to 17 per cent. digestible protein) in the ration of the young growing pig ; but the best milling offals will only contain about 17 per cent., whilst barley and maize meals contain much less. Separated milk, on the other hand, contains (in its dry matter) as much as 35 to 40 per cent. of protein, practically all digestible. An addition of separated milk to a cereal ration thus effects a very substantial increase in the amount of protein supplied.

With regard to the " quality " of cereal proteins, the research of recent years has revealed that they are in certain respects defective in their " make-up " for the purpose of manufacturing the proteins of the body, which constitute a great part of new growth (flesh, blood, etc.) American experiments with calves and pigs have demonstrated that the proteins of wheat or maize are by themselves ill-adapted for meeting the protein needs of the growing animal. The proteins of milk, on the other hand, provide all that is necessary in this respect and thus can remedy the defects of the cereals.

It seems probable that this " quality factor " in the proteins of milk may be more important than the influence of the increased quantity of protein, since the latter can hardly

furnish an explanation of the beneficial effects of whey, which contains (in its dry matter) only about 10 per cent. of protein. Whatever the precise nature of the effect may be, it would appear certain that some part of the explanation of the defects of the cereal diet must lie in the protein supply, since, with the exception of whey, all other foods which have been found to confer a sensible improvement on the cereal diet are rich in protein.

The Mineral Factor.—With regard to mineral matters the position is, perhaps, simpler. We need only recall the importance of sound bone development, in determining satisfactory growth, in order to emphasize the importance of a suitable supply of mineral matters in the diet of the growing animal. Generally speaking, fully one-half of the dry substance of the bone consists of mineral matters of various kinds, of which by far the most abundant is the combination of phosphoric acid and lime known variously as tricalcic phosphate, phosphate of lime or bone phosphate. Obviously, therefore, the supply of phosphoric acid and of lime must be of vital importance to the young, growing animal. With regard to these ingredients we find that cereals and the meals prepared from them, although well provided with phosphoric acid, are mostly very deficient in lime. Practical experience demonstrates that this shortage of lime is an important contributory cause of the defects of the cereal ration, and an addition of lime in some form usually effects a marked improvement. Some, indeed, are inclined to give the major part of the credit for the improvement effected by certain additions to the cereal ration, such as fish meal, to the improved supply of lime and possibly other mineral ingredients thereby provided, but such an extreme view is hardly warranted as yet by the experimental evidence available.

That the mineral factor alone is not sufficient to explain the inferiority is indicated by recent experiments at the Harper Adams College, in which a ration of cereals, plus minerals, gave results decidedly inferior to those obtained with the same rations to which a supplement rich in protein was added, as indicated in the following summary :—

Ration	Average gain per head in sixteen weeks lb.
Cereals + minerals	112·5
Cereals + minerals + bean meal	143·7
Cereals + minerals + soya meal	147·0
Cereals + minerals + groundnut meal ..	138·0
Cereals + fish meal	141·4

These results confirm the view, expressed above, that some supplement of protein to the cereal ration is essential for securing efficient utilization.

We referred above only to lime and phosphoric acid, but there are other mineral matters essential to normal growth, such as potash, soda, iron and iodine, and it may be that the cereal ration is, also, either deficient or badly balanced with regard to one or more of these, but evidence as to this is very scanty as yet. Here and there, practical rearing difficulties have been met with which seemed to be clearly due to deficiency of iron in some cases, and of iodine in others, but the only mineral shortage which can definitely be said to be widespread is that of calcium or lime.

The Vitamin Factor.—As to the vitamin factor in determining inferiority of plain cereal rations, whilst it is true that milk is normally well supplied with the growth-promoting vitamins (A and D), no great merit in this respect can be claimed for separated milk, since these particular vitamins will tend to accompany the fat into the cream. Moreover, some of the "accessory foods," which produce a marked improvement in the cereal ration, are also not of much importance as sources of the vitamins A and D. Other vitamins are doubtless supplied by separated milk and the other "accessory foods," but we have no reason to think that the cereals themselves are specially deficient in these items. On the whole, the evidence, obtained under the conditions of practical pig feeding, gives no indication of any widespread trouble due to vitamin deficiency; and it seems likely that any part this factor may play in determining the inferiority of the cereal ration is of minor practical importance compared with the protein and mineral factors. The supply of green food, which is a usual feature of good pig management, will generally provide an adequate safeguard against vitamin deficiencies, and must certainly not be overlooked in the case pigs reared entirely in confinement.

Of the various "accessory foods" which are now known to produce a marked improvement in the cereal ration the chief are the following: milk and milk products in both the liquid and the dried or partly dried form, dried blood, meat meal, fish meal, whale meat meal, dried yeast, bean meal, pea meal, soya meal and groundnut meal. Notes on each of these are appended.

Milk and Milk Products.—On the dairy farm, milk may be available for pig feeding in the four forms of whole milk,

separated (or skim) milk, buttermilk, and whey. The following figures give a general idea of the composition of these materials :—

	Whole milk per cent.	Separated milk per cent.	Skim milk per cent.	Butter-milk per cent.	Whey per cent.
Moisture	87·2	90·6	90·3	90·8	93·4
Protein	3·4	3·5	3·5	3·6	0·7
Fat	3·9	0·1	0·4	0·8	0·2
Sugar	4·8	5·0	5·0	4·1	5·0
Mineral matters ..	0·7	0·8	0·8	0·7	0·7
Starch equivalent	17·1	8·3	9·1	9·2	6·1

It will be noted that, apart from whey, the only marked difference is in the proportion of fat, though buttermilk is also a little down in milk-sugar. Whey is not only poor in fat, but also in protein, as compared with the other products.

The starch equivalents suggest that whole milk should have, roughly, twice the feeding value of separated milk, skim milk or buttermilk, and three times the feeding value of whey. Practical feeding tests with pigs, carried out on a very large scale in Denmark and Sweden, roughly confirm these relative values, so far as milk and separated milk are concerned, but give a slightly lower value to whey, namely one-half that of separated milk. These Scandinavian tests indicated that 3½ lb. of whole milk or 6 lb. of separated milk or 12 lb. of whey would replace 1 lb. of mixed cereal meal. Skim milk and buttermilk will vary considerably in value according to the degree of completeness with which the cream or butter has been removed, but, generally speaking, should have a slightly higher feeding value than separated milk. It is assumed, of course, that the buttermilk has not been diluted with water.

Apart from whey, the outstanding characteristic of all these dairy products is their richness in protein, which forms, in each case, roughly one-third of the total nutritive matters present. They possess also the advantage of easy digestibility with regard to all ingredients, and their mineral matters, whilst present in comparatively high proportion in relation to the mineral needs of the body, are also admirably balanced in nature for meeting the needs of growth. Thus, three-quarters of the mineral matter consists of lime, phosphoric acid, and potash in, roughly, equal proportions.

Whey, on the other hand, is no richer in protein than the cereals, the "dry matter" of whey containing only about 10 per cent. of protein, though this is probably of better "quality" for the purposes of growth than the cereal protein. It is probably desirable, however, to supplement whey with a little

food rich in protein. The mineral matters of whey are distinctly poorer in lime than those of separated milk, so that it is not as effective as the latter for remedying the lime-deficiency of the cereals. It would seem desirable, therefore, when using whey, to supplement it with a little food rich in protein and lime (*e.g.*, fish meal or medium grade meat meal).

In order to secure the maximum value from milk and liquid milk products, it is desirable to maintain a reasonable balance between the amount of milk and the amount of meals consumed. American and Danish experiments on this point suggest that the best ratio is about 5 lb. of milk to 1 lb. of meal for young animals, reduced to 3 lb. of milk to 1 lb. of meal for older animals, or say 1 gal. of milk to every 2–3 lb. of meal according to age.

In addition to milk, and the foregoing milk products, produced directly on the farm, the same materials can now be obtained in dried or semi-dried form as dried milk (whole or separated), condensed milk (whole or separated), dried buttermilk, semi-solid buttermilk, whey paste and dried whey. Broadly speaking, all these products retain the nutritive virtues of the raw materials from which they are produced, and consequently must be regarded as feeding-stuffs of the highest quality, although, in certain respects (such as digestibility, physical character of some of the ingredients, and vitaminic efficiency), they are not quite equal to the fresh, liquid, raw material. For practical purposes, however, they may be valued by comparision with the raw materials on the basis of equal dry matter content. Thus 1 lb. of dried separated milk may be regarded as roughly equivalent to 1 gal. of liquid separated milk, the latter containing approximately 1 lb. of dry matter. Similarly, 1 lb. of dried whey may be taken as roughly equivalent to $1\frac{1}{2}$ gal. of liquid whey. A similar basis of valuation may be taken for the " condensed " or " semi-solid " products, although, in the case of whey, the value of the product may have been lowered somewhat by the removal of the albumin in the course of the concentration process.

Buttermilk also differs in one respect from the other products, in that, being produced normally from soured cream, it contains a certain percentage of lactic acid which may, conceivably, under certain conditions, exercise beneficial effects upon the digestive system of the animal. Certainly practical experience with condensed buttermilk appears to have been generally favourable, apart from the disadvantage which it suffers in common with most of these manufactured milk products of

being unobtainable at an economic price. The data in the following table will give an idea of the general composition of these milk products :—

	Dried whole milk	Dried separated milk	Condensed whole milk (unsweetened)	Condensed separated milk (unsweetened)	Dried buttermilk	Semi-solid buttermilk	Whey paste	Dried whey
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Water	4·2	10·2	61·4	68·6	10·0	70·4	44·4	7·2
Fat ..	26·5	0·3	11·4	·3	11·2	3·7	1·3	3·0
Lactose	37·4	48·8	14·0	15·7	*24·3	*8·0	*27·8	*68·4
Protein	25·5	32·8	11·2	12·4	42·3	13·9	17·2	13·6
Ash ..	6·4	7·9	2·0	3·0	12·2	4·0	9·3	7·8
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Containing lactic acid	..	..	..	..	*?	*4·3	*?	*2·7

Bean and Pea Meals.—Before the War, these meals were probably the most widely used in association with cereals in pig feeding, where milk was not available. They are the most nitrogenous foods that can be grown successfully on our farms, and, for long, represented the only foods rich in protein and suitable for the pig that were generally available. Linseed cake was usually too dear and could, in any case, only be used to a very limited extent, whilst cotton cake was rightly condemned as unsuitable, and practically no other highly nitrogenous feeding stuffs were available in large quantities.

Both beans and peas contain usually about 23 to 25 per cent. of protein, and, when used in moderation, do not unfavourably affect the quality of the bacon, although, when more freely used, they tend to produce an undesirable hardness in the cured meat. Generally speaking the various types of beans in the market (field beans, Rangoon beans, etc.), if in good physical condition, seem to have pretty much the same nutritive value, but the soya bean must not be included with them, as it is an entirely different article.

Although the addition of beans or peas to the cereal ration usually produces a marked improvement, it still leaves much to be desired ; and the results of recent experimental work suggest that the mineral constitution of the ration containing bean or pea meal is still defective. Thus in the Harper Adams experiments, quoted above (p. 708), the results obtained by adding bean meal *plus minerals* to the basal cereal ration were

practically equal to those obtained with any of the other supplements, and this experience has been confirmed elsewhere. In these experiments bean meal formed about 20 per cent. of the total food, and mineral mixture, rich in lime, was added to the extent of about 2 per cent. It is doubtful wisdom, however, to include bean or pea meal beyond about 25 per cent. of the total ration, as otherwise the above-mentioned detrimental influences upon the quality of the product are liable to become unduly prominent.

Dried Blood.—This material, as its name implies, consists of the solid matters of blood remaining after removal of the water by evaporation. The blood is usually heated until fully clotted, the clot being then removed and thoroughly dried by heat, and the resultant dark brown or black residue ground to a meal. When prepared from fresh blood and quickly dried, it is obtained in a tasteless, odourless form, and, if thoroughly dried, keeps well. Almost needless to say, only the blood of perfectly healthy animals is suitable for the manufacture of dried blood intended for use as food. The composition is usually somewhat as follows :—

Moisture	10 per cent.
Protein	85 ,,
Oil	1 ,,
Carbohydrates	1½ ,,
Ash	2½ ,,

It is thus extraordinarily rich in protein, and, moreover, this protein is of excellent quality for flesh formation. On the other hand, it is distinctly poor in mineral matters, and should in practice be supplemented by an addition of about 2 per cent. of a mineral mixture rich in lime. The proportion of dried blood that can safely and economically be introduced into feeding rations will usually be about 5 to 7 per cent., and when mixed in this proportion with cereal foods excellent results have been obtained. Unless great care is exercised, however, to avoid excess, it is liable to have an unduly laxative effect. Moreover, if used injudiciously, the quality of the carcass may be impaired. Excellent results have been obtained by its use in many cases with backward or unthrifty animals.

Meat Meal.—This is another product of the slaughter house, obtained by drying down the wholesome offal, scraps, blood, etc., that cannot be utilized for human consumption. Other meat waste may also be included in the raw material which is dried down. In the course of the drying a considerable proportion of the fat is melted and run off, but the final product is still liable to contain rather a large proportion of fat, which

detracts from its value in pig feeding, since such fat is not conducive to high quality of the bacon. This objection is overcome, in some of the modern meat meal manufacturing plants, by subjecting the material to extraction with benzine, which dissolves out the greater part of the fat.

A meal, made purely from meat, would contain 70 to 75 per cent. of protein, but this class of material is rarely obtainable, as the process of removing all bone from the carcasses, etc., would be too expensive. The material most commonly supplied contains a proportion of bone, which reduces the protein to the region of 50 to 60 per cent., but, at the same time, furnishes an appreciable proportion of phosphate of lime, in which the meat itself is deficient. The class of meat meal which is probably most generally useful contains about 60 per cent. protein with about 15 per cent. phosphate of lime and not more than 5 per cent. of fat. Some meat meals, however, contain as little as 45 per cent. protein and would be more correctly described as " bone and meat meals." In buying meat meal, therefore, it is important to obtain the proper guarantee of composition, and in view of the risk of infected materials having been used in the manufacture, it is also desirable to have some assurance that the material is wholesome and safe for use as food for live stock. The fact of the material having been thoroughly heated in its manufacture cannot by itself be regarded as an adequate safeguard. It is further desirable that the meal should be well-ground and free from sharp splinters of bone.

The proportion of meat meal which should be introduced into rations will vary with its richness in protein, but with meal of average quality a proportion of about 10 per cent. is usually ample and has produced excellent results both in experiments and in commercial practice. If the meat meal is rich in fat, it is probably best to restrict the proportion to 5 per cent. and make up the balance of protein required with some other food rich in protein and poor in oil, such as dried blood or extracted soya meal.

Fish Meal.—This product is similar in general character to meat meal, being produced by the drying of surplus fish and fish offal, including a varying amount of bone. In this case, however, there arises the important consideration that fish has a distinctive flavour, in some cases very pronounced, and unless special precautions are taken as to the class of raw material used, and in the use made of the fish meal, there is serious risk of a fishy taint being imparted to the bacon. The production of this taint is commonly associated with the fish oil, although

the experimental evidence on this point is not very conclusive, and it is generally agreed, therefore, that the proportion of oil in fish meal should be kept as low as possible. With this object in view, the more reputable manufacturers confine their raw material to the class of fish described in the trade as "white fish," excluding all strongly flavoured and oily material such as comes from herrings, etc. Further, in view of the sensitiveness of the pig to excess of salt, it is necessary that salted materials shall also be excluded.

Unfortunately, with the growth of the demand for fish meal, a good deal of material has been placed upon the feeding stuff market which does not comply with these requirements and is more fitly described as "fish manure." It is necessary, therefore, to use very great care in the purchase of fish meal, and in particular to regard with the gravest suspicion all meals containing a high proportion of oil or having an offensive smell. For the safeguarding of the purchaser in these respects, the leading manufacturers have adopted a standard warranty for fish meals intended for feeding purposes, in accordance with which the material is marketed under the definite name of "White Fish Meal," and guaranteed to contain not less than 55 per cent. of protein and 16 per cent. of phosphate of lime; and not more than 5 per cent. of oil and 4 per cent. of salt. The prospective buyer should, therefore, insist upon a warranty in these terms, and should reject any material for which such a warranty cannot be obtained. It may be noted that under the Fertilizers and Feeding Stuffs Act, 1926, it is an offence to sell as "White Fish Meal" an article containing more than 6 per cent. of oil or 4 per cent. of salt.

Such a meal, as described above, should be light-brownish in colour, well-ground and free from large pieces of bone, and should not have more than a stale fish smell, certainly nothing approaching the offensive smell associated with putrid fish. The moisture content is usually below 12 per cent., and, in this condition, the meal will keep in sound condition for many months in a dry store.

Of all the substitutes for milk used in pig-feeding fish meal has, in recent years, proved the most popular. After preliminary experiments at Seale-Hayne College (1913) and at Garforth (1915) had drawn attention to its outstanding merits the use of fish meal spread rapidly in practice, not only in pig-feeding, but also on poultry farms, until the demand soon exceeded the possible supply of legitimate "White Fish Meal," and led to the abuses referred to above, which unfortunately still

persist. Further experiments on a more extended scale have fully confirmed the earlier results and have established beyond question the high value of this feeding stuff as a supplement to cereal foods in the rations of the growing pig, the chicken, and the laying hen.

Much controversy has arisen, however, upon the question of the degree of risk of taint associated with the use of fish meal. On the one hand the bacon curers, having suffered great losses through undoubtedly tainted carcasses, are unsparing in their condemnation of the use of fish meal of any kind; whilst, on the other hand, experiments have repeatedly shown that where suitable material is used, under properly controlled conditions, no risk of taint need arise, especially if the use of fish meal is discontinued for a short time before slaughter. On a large number of farms, however, these necessary precautions are not observed, little care being exercised either to ensure that the fish meal purchased is the legitimate type of feeding meal described above, or to avoid excessive use. It is these feeders who create the taint problem and justify the refusal of fish-meal fed pigs by the curers, who can hardly be expected to be able to exercise a nice discrimination between the careful and careless users.

Experience has now quite definitely established the conditions necessary to avoid trouble, namely that the meal shall be a genuine "White Fish Meal," and that it shall not form more than 15 per cent. of the ration in the earliest stages, and 5 per cent. in the latest stages of feeding, up to the last week or two, when its use should be entirely discontinued. Incidentally, it may be said that, quite apart from the question of taint, the above proportions probably represent the limits of economy in the use of fish meal, so that there is no excuse for more lavish use. No feeder who is not prepared to adopt the above precautions and ensure that they are carried out in the piggery should use fish meal at all.

The special value of fish meal in pig feeding is not confined to the increased rate of growth secured by its use, but it is the common experience that it exercises a beneficial influence also upon the general health of the pigs. These combined advantages have been variously attributed to the proteins, vitamins, and the mineral salts (especially phosphate of lime) supplied by the meal, but there is some reason to think that the combined influence of these factors does not entirely account for the improvement effected. More recently, the suggestion has been made that the small quantity of iodine contained

in the meal may be a deciding factor, and experiments upon this point are now in progress.

Whale Meat Meal.—This product is closely allied to fish and meat meals, being, as its name implies, prepared from the residues of whale meat, after removal of the blubber. The difficulties of drying this material in sufficiently fresh condition appear to have been largely surmounted, and, as now marketed, it forms a wholesome meal with which very good feeding results have been obtained. It usually contains rather a high content of oil (10 to 12 per cent.), which must be regarded as a disadvantage from the point of view of the production of bacon of high quality. The protein content usually runs much the same as in fish and meat meals. Mineral matter inclines to be low in pure whale meat, but this deficiency is easily rectified.

Dried Yeast.—Although a vegetable product, dried yeast in many respects resembles the foregoing protein-rich foods of animal origin. It is made by drying the surplus yeast of the breweries, with or without special treatment to remove the ingredients which impart the bitter unpalatable taste to raw yeast. Generally speaking, the presence of these bitter principles is of no serious detriment in yeast intended for live stock, since there is usually little difficulty in inducing stock, especially pigs, to consume it. Yeasts may vary considerably in protein-content, so that the guarantee of this ingredient is essential, but the usual grades of dried yeast contain about 45 per cent. protein. Oil is very low, which must be accounted an advantage. The fresh yeast is rich in vitamin B, but the activity of this is probably very considerably reduced in the drying process. Usually the drying will destroy the vitality of the yeast cells, so that the dried yeast can be mixed with the other foods of the ration without risk of undue fermentation.

In pig-feeding tests with dried yeast, made at Garforth in 1916, using it to the extent of about 10 per cent. of the meal supply, good results were obtained, and these have been subsequently confirmed in practice, as also with poultry.

Soya Bean Meal.—This meal represents the residue after the removal of most of the oil from soya beans, and may be either soya cake meal or extracted soya meal. The essential difference between these two classes is the higher content of oil in the cake meal, and, since soya oil has rather pronounced laxative properties, preference is generally given to the extracted meal.

This extracted meal usually contains about 45 per cent. of protein and 1 to 2 per cent. of oil, but, in order to get the best

results, a supplement of mineral matter rich in lime is necessary. The quality of the soya proteins for the purposes of flesh formation seems to be excellent, and in recent experimental work with rations containing up to about 12 per cent. of soya meal, together with 2 per cent. of steamed bone flour or mineral mixtures, rates of growth equal to those obtainable with equivalent quantities of meat or fish meals have been obtained. Similarly good results have also been obtained by the use of soya meal in the feeding of poultry for egg production. It is probably desirable, however, both with pigs and poultry, to keep the proportion of soya meal within the limits above indicated, since in certain cases distinctly unfavourable effects have been produced with higher quantities.

Decorticated Groundnut Meal.—This product is similar in general character to soya meal, being the residue remaining after the removal of oil from groundnuts by commercial processes of pressure or extraction. In the case of groundnuts, however, it is necessary to bear in mind that the nuts are carried in a fibrous shell, more or less of which may be incorporated in the meal. Where no special effort is made to remove this shell, the product obtained is properly described as undecorticated groundnut cake or meal and is quite unsuitable for pig feeding. For this purpose the only class of meal that will serve is the decorticated meal prepared from nuts from which the shells and a good part of the actual skin of the nuts have been removed. This material is obtainable in the two forms of "cake meal" or "extracted meal," differing, as in the case of the corresponding soya meals, essentially only in their oil content, this being the higher in the "cake meal." As groundnut oil has no detrimental effect upon the general welfare of the pig, it is a matter of little consequence which of the two forms of meal is used, but considerations of the possible detrimental influence of the oil upon the quality of the bacon will usually incline the choice in favour of the extracted meal, which has the further merits of being the lower-priced and the richer in protein.

A good extracted groundnut meal will contain from 50 to 55 per cent. of protein, along with 1 to 2 per cent. of oil. As with soya meal, its mineral matters are defective in amount and kind for the purposes of growth and need to be supplemented, especially with respect to lime. Excellent results have been obtained in recent pig-feeding experiments with rations containing about 10 per cent. of groundnut meal, along with about 2 per cent. of mineral mixture, the rates of

growth obtained being practically equal to those obtained with equivalent quantities of fish or meat meals.

Summary.—(1) Attention has been directed above to the fact that rations consisting solely of cereal foods are incapable of giving satisfactory results with growing pigs. (This statement might be applied generally to all classes of young, rapidly growing live stock.)

(2) For the purposes of production of flesh and bone, the cereal foods are not only defective in the amount and "quality" of their proteins, but in the amount and "balance" of their mineral matters, being particularly poor in lime. Further, under certain conditions of feeding their poverty in the growth-promoting vitamins may be a factor of practical importance.

(3) The best supplement to the cereal ration is milk, either as such or in the form of the liquid dairy by-products, such as separated (or skim) milk, buttermilk and whey. Whole milk is probably the most efficient of all substitutes, but is closely followed by separated milk and buttermilk. Whey will generally have about one-half the value of separated milk. Probably, the next best substitute for the liquid milk-products will be the condensed and dried forms of these products, but their value is commonly more than neutralized by considerations of cost.

(4) For the pig feeder who is unable to command supplies of milk or milk-products, a choice of various feeding meals is available which when blended in quite small proportions, usually about 10 per cent., with cereal meals will produce results not far short of those obtainable with milk, the somewhat slower rate of growth being usually compensated by lower feeding costs. Certain of these materials, such as meat meal, dried blood, fish meal and whale meat meal, are, like milk, of animal origin; but equally good results are obtainable under proper conditions with various materials of vegetable origin such as dried yeast, bean meal, pea meal, soya meal and ground-nut meal. In the last-named cases, however, as in the case of dried blood, it is essential that a small proportion (usually about 2 per cent.) of mineral matter rich in lime shall be fed with the meal.

The proportion of these special meals included in the ration is usually kept within the region of 10 per cent., or such proportion as supplies roughly the same amount of protein as 10 per cent. of fish meal, and it is doubtful economy to go far beyond these limits. These special supplements are most effective during the earlier stages of the life of the pig, when it

is growing quickly, and the proportions used may be reduced with advantage in the later stages.

The influence of these supplements upon the quality of the final product is less satisfactory than their influence upon the rate of growth, and in many cases special care is necessary to avoid the production of a distinctly inferior quality of bacon. The point is one upon which existing knowledge is very inadequate, and further investigation is urgently needed.

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WINTER FEEDING OF DAIRY COWS

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IN many parts of the country there are dairy farmers who have relied upon hay as the only home-grown feeding stuff for their cows, but owing to the bad weather conditions this year at hay-time, much of the hay has been damaged. The question asked in such cases is how to feed cows during the coming winter.

Where the farmer has good hay left over from the previous year, or has made sufficient good hay for his cows this season, no difficulty arises. On many farms, however, the position is that the hay can be grouped under three heads: (1) Good hay; (2) moderate hay; and (3) bad or ruined hay.

The first thing to be realized is that group 3 (bad hay) is of little value to the dairy farmer for his cows, for it has lost its value as a feeding stuff much as though it had been partly burnt. If such hay is fed to cows it may lead to indigestion and death. If the value of hay has been lost in the making it is poor consolation to lose good cows in the consuming of it. Where the hay on any farm is all of this type there is unfortunately no alternative but to purchase (*a*) hay, or (*b*) straw, plus sugar beet pulp or roots. Happily not many farmers are in this position, most of them having some hay that has not been ruined.

The good and the moderate hay should be fed concurrently, *i.e.*, if the farmer has one-third good hay and two-thirds moderate hay, then the cows should receive one feed of good and two feeds of moderate hay per day, so as to keep the hay supply to the cows more or less uniform throughout the winter. It is a mistake to feed all the best quality hay at one time of the year and the poorer at another time.

The bulk of the hay fed must be strictly controlled, allowing not more than a total of 20 lb. per cow for cows giving three gallons of milk or less per day, and reducing this amount to the

higher-yielding cows in proportion to the increase in cake. The hay that should be reduced for the higher-yielding cows is the moderate hay, leaving them as far as possible the better hay on the farm.

Where most of the hay is moderate its feeding value will be low and consequently it will be necessary to supplement it with other foods to provide a maintenance ration. This can be done by supplementing the hay with 2 to 3 lb. of cereals or rice meal or maize meal, or of the ordinary ration, or by reducing the quantity of hay from 20 lb. to 14 lb., and feeding 6 lb. of sugar beet pulp per cow. It is preferable to do this rather than to increase the quantity of the hay, for if this is done it means that the bulk of the ration will be too great, and will not permit of the cows dealing efficiently with the production ration. If hay is poor but plentiful it may be fed in large quantities, the cows being allowed to pick out the better portions; it is, however, then necessary to put a time limit upon them, and remove the hay that is left 20 minutes after it has been given to them. The hay should be given in three small feeds—after milking in the morning, at noon, and as late as practicable in the evening. Great care should be taken that the evening feed is no greater than the other feeds, for if it is too bulky it leads to indigestion, which does not permit of the digestive organs resting in preparation for the next day's work. If the hay is properly controlled it is surprising how little is required, especially if the herd is a high-yielding one. The writer does not reckon to use more than one ton of hay per cow per winter.

The chief difficulty about this year's hay crop, however, lies not so much in its loss of feeding value, as in the fact that most of it is of a binding nature, and not sufficiently laxative when fed in the ordinary way with ordinary rations. The keeping down of the bulk will largely counteract this, and the difficulty can be overcome by feeding laxative production rations. In most cases a balanced ration low in fibre will give this result, such as the following :—

1 part decorticated ground nut cake
2 parts rice meal .. .. ..
2 parts palm kernel cake .. ..
1 part linseed cake .. .. ..
} 3½ lb. per gallon.

Where, however, this is not sufficient, then one of the best recommendations is to feed all cows for the first gallon with 3½ lb. of coconut cake. The cake should be soaked overnight, thus allowing it to swell up into a thick porridge, and then fed to the cows as the first feed of the day. If coconut cake is not available, then 5½ lb. of bran, fed as a mash, or 16 lb. of wet

grains may be used for the first gallon of milk. In each case a laxative production ration should be fed for each gallon beyond the first.

Another alternative is to feed the heavier-yielding cows with a very laxative ration (*e.g.*, 1½ lb. raw linseed meal and ½ lb. fish meal) for the last gallon, feeding only 2 lb. to the gallon, and for not more than one gallon per cow. These feeding stuffs may appear expensive, but it must be remembered that only 2 lb. are required, and consequently it is only about the same cost as 3½ lb. of the ordinary balanced ration.

Finally it must be remembered that cows receiving indifferent hay should have an adequate supply of water, and that they cannot go long periods without a drink; it is, therefore, eseential that they should have access to water three times a day, and that one of these times should be in the evening.

To sum up the recommendations :—

(1) The good and the moderate hay should be fed concurrently.
(2) The bulk should be controlled.
(3) The hay should be given at three feeds.
(4) All hay remaining 20 minutes after feeding should be removed.
(5) The cows must be kept laxative, with a laxative production ration, and supplementary laxative rations.
(6) Ample supply of water.
(7) The deficiency in the hay to be made up either by beet pulp, or concentrates, or, perhaps the easier, feeding each cow for half a gallon of milk more than she is giving.
(8) Don't kill good cows by giving really bad hay.

The writer is well aware that farmers are very hard hit financially and are not in a position to lay out a lot of money, but a farmer selling milk generally receives payment monthly, and it is out of this money that he must buy the feeding stuffs for his cows; the hay being poor it is all the more imperative that the feeding stuffs must not be stinted. The cows can only make milk from food, or from their own body tissues, and from the latter only for a limited time.

If the above recommendations are followed it will be found that cows can be kept to pay, but if on the other hand a farmer who has had a disastrous summer stints his cows with feeding stuffs, the bad summer is likely to be followed by an equally disastrous winter owing to a drop in the sales of milk, and loss of health in the cows.

DAIRY COWS AND WINTER FEEDING

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IT has been stated that the most suitable maintenance ration, or bulky food, for a dairy cow is a strictly limited and controlled quantity of good quality hay. This view may, or may not, be correct, but so far as this article is concerned, it is necessary neither to agree nor to disagree with it. The object here is to show that perfectly satisfactory, and even high, yields of milk, can be secured with the use of roots and other home-grown feeding stuffs.

There are many farms throughout the country where milk production is but a subsidiary part of the general business of farming. On such farms it is not convenient to restrict the feeding of cows to the use of hay and concentrates. In advising farmers in connexion with feeding for milk production, it seems necessary to study the individual's circumstances, and to include the foods which he has available. In view of the general depression in farming, the shortage of money, and the difficulty of marketing certain home-grown produce at remunerative prices, particularly when the produce is slightly damaged, many farmers wish to buy as little as possible, and desire to utilize as fully as may be practicable the materials grown on the farm. In most districts the root crop is good, and farmers can be assured that roots in limited quantities form suitable food for dairy cows, including those giving high yields of milk. In this connexion it may be of interest to recall the results secured in Mr. F. B. May's herd of Friesians in Essex, as recorded by Dr. Scott Robertson in this JOURNAL (May, 1919). The average yields of these cows and heifers were as follows :—

Year.	*Number in the herd.*	*Average quantity of milk (gallons).*
1915	13	1,044
1916	13	1,112
1917	12	1,334

During the first two of those three years, the winter ration contained 56 lb. of roots, *viz.*, kohl rabi before Christmas, and mangolds from Christmas to April, together with a quantity, up to 10 lb., of oats' "glumes" per cow, per day. In the last winter the ration was altered to the following :—

Mid-October to Christmas.		*Christmas to May* 1.
66 lb. kohl rabi.		84 lb. mangolds.
1½ lb. oats.	Per gal. of milk	1½ lb. oats.
2 lb. bean meal.		2 lb. bean meal.

With regard to this ration, Dr. Scott Robertson says that it " is somewhat exceptional, inasmuch as it does not include any straw or hay. Previous experience showed that the cows were not able properly to digest such a strong bean meal mixture as the above, but by increasing the quantity of roots and eliminating the chaff this difficulty was overcome, and the above winter ration was fed with excellent results, as the average of 1,334 gal. per cow for the 1917 lactation period testifies." It should be understood that these yields were obtained with twice a day milking, and if we are to compare them with those obtained in other cases, where three times a day milking has been practised, it will be necessary, in order to secure a fair comparison, to deduct some 20 or 25 per cent. from figures obtained by milking three times daily. Jesse has given in this JOURNAL (August, 1925) an account of his extensive experience in the feeding of dairy cows in East Sussex. From the results he obtained it would appear that roots, up to 45 lb. per cow per day, have an effect in increasing the yield of milk. It also would appear that a suitable amount of fodder to feed with this quantity of roots is about 17 lb. per head per day. In Northamptonshire herd averages of upwards of 1,100 gallons (three times a day milking) and over 900 gallons (twice a day milking) have been secured with rations containing 35 to 40 lb. of roots, together with a limited quantity of fodder. In some cases this fodder has contained a proportion of straw along with the hay.

Maintenance and Production Standards.—A Shorthorn cow of 1,250 lb. live weight requires a *maintenance ration* supplying about 7 lb. starch equivalent, and containing 0·74 lb. protein equivalent, per day. For *production* purposes the cow requires a further ration supplying 2·5 lb. starch equivalent, containing 0·6 lb. protein equivalent, per gallon of milk. The standards for maintenance vary with the breed and weight of cow, and for production according to the quality of the milk. Detailed information regarding the standards for the various breeds will be found in the Ministry's Report on the Rationing of Dairy Cows, page 36. The total dry matter, which a Shorthorn cow can deal with daily, is in the neighbourhood of 30 to 33 lb.; in the case of a heifer it is from 27 to 30 lb.

Production Rations.—Building on the basis of the foregoing information, it is possible to devise maintenance rations for dairy cows in a variety of ways.

Most farmers should have at least some medium quality hay this year. Their poorest hay will not be suitable for dairy

Example 1.	*Dry matter.*	*Starch equivalent.*	*Protein equivalent.*
40 lb. swedes	4·60	2·8	·28
10 lb. medium hay ..	8·57	3·10	·46
7 lb. oat straw	6·02	1·19	·06
	19·19	7·09	·80

cows, and every effort should be made to give the rather better quality stuff to the milking cows. On arable farms it should be possible in many cases to make up such a ration as in Example 1 above. Using this ration it would be possible to feed concentrates for cows giving up to 4 gallons of milk (3½ lb. per gallon, *i.e.*, 14 lb. cake or meal, supplying about 12 lb. dry matter) without exceeding the limit for total dry matter per day. With cows giving 5 gallons and upwards it will be necessary to reduce the fodder to the extent of 3½ lb. for each additional 3½ lb. of concentrates fed, in order to keep the total dry matter fed daily down to 30 to 33 lb.

Example 2.	*Dry matter.*	*Starch equivalent.*	*Protein equivalent.*
40 lb. mangolds	5·28	2·80	·16
17 lb. oat straw	14·62	2·89	·15
1 lb. decorticated ground nut cake	·90	·73	·41
	20·80	6·42	·72

This maintenance ration would be suitable on an arable farm where there is no good hay available. In feeding a ration like this it is exceedingly important to bear in mind the rules which should apply to the feeding of all fodder, namely, that concentrates should be fed first, before roots and fodder, that it is preferable to give three feeds daily, and that fodder should be fed long—not chaffed. It is advisable to give the cows just enough time to pick over the straw and eat the best of it, then to clear the remainder out of the rack or manger. Racks and mangers should be completely emptied every evening to prevent the cows eating second-rate quality, or fibrous indigestible material, if hungry overnight.

Example 3.	*Dry matter.*	*Starch equivalent.*	*Protein equivalent.*
40 lb. mangolds ..	5·28	2·8	·16
10 lb. (medium) hay ..	8·57	3·10	·46
7 lb. wheat straw ..	6·02	·77	·007
1 lb. crushed wheat ..	·87	·72	·1
	20·74	7·39	·727

One pound of crushed wheat could be used to supplement medium quality hay and wheat straw, in order to raise the starch equivalent and protein equivalent to the required standard. With better quality hay, the pound of wheat, or other cereal, would not be necessary.

In special circumstances potatoes may be used in conjunction with medium hay, as follows :—

Example 4. (*In special circumstances.*)	*Dry matter.*	*Starch equivalent.*	*Protein equivalent.*
40 lb. potatoes ..	9·52	7·20	·24
10 lb. (medium) hay ..	8·57	3·10	·46
	18·09	10·30	·70

It will be seen from these figures (starch equivalent 10·30 lb.) that potatoes supply an excess of starch. In order to balance this starchy excess, it is advisable to feed a food very rich in albuminoids (protein) to supply the required protein for the first 1 or 2 gallons of milk. Decorticated cotton seed cake or meal, at the rate of 1¾ lb. for each of the first 2 gallons would be suitable. As potatoes have a laxative tendency, the concentrated food should be selected to counteract this. Any ordinary balanced mixture, at the rate of 3½ lb. per gallon, could be fed for the third and subsequent gallons. As this maintenance ration is comparatively low in dry matter, it is possible to feed for 5 gallons of milk without it becoming necessary to reduce the amount of hay fed.

With regard, generally, to feeding potatoes, it is advisable to start with a very small quantity per day, say 3 or 4 lb. Unless this is done cows are liable to become blown or hoven, or to suffer from other digestive troubles. Provided that increases are made very gradually, it has been found possible to go to 40 lb. per head per day with good results. A herd fed in this way last winter averaged over 3 gallons per day. Potatoes should be fed whole. After cows become used to potatoes they appear to relish them, even when the tubers are not of first-class quality.

Production Rations.—In the case of low-yielding cows, *i.e.* those giving only 1 or 2 gallons of milk per day, it is possible to utilize some bulky foods for production purposes. For example :—

12 to 14 lb. kale and 1½ lb. decorticated cotton seed meal may be used to supply the nutriment required for 1 gallon of milk.

7 lb. of good hay, or 7 lb. moderate hay, and ¾ lb. to 1 lb. decorticated cotton seed cake or meal, or decorticated earth nut cake or linseed cake, form a suitable ration for the production of 1 gallon of milk.

The following foods are sufficient for 2 gallons of milk: 12 to 14 lb. roots, 7 lb. hay, 2 to 2½ lb. decorticated cotton seed meal.

In the case of cows giving 3 gallons and upwards, it is better to use concentrated foods only, for production purposes. Home-grown feeding stuffs, such as beans and oats, may be utilized in the same proportions as were employed in

Mr. F. B. May's herd, referred to above. It is not suggested, however, that fodder should be eliminated when beans and oats are fed with roots. It is only in exceptional cases with very high-yielding cows that this would be advisable.

The following is a production ration to utilize slightly damaged or discoloured cereals :—

1 lb. decorticated ground nut cake.
1¾ lb. oats (crushed).
1 lb. barley (crushed).
3¾ lb. per gallon of milk.

Many other mixtures, quite suitable for milk production, can be made up. Farmers requiring assistance in this connexion should apply to their County Agricultural Organizer.

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FIELD EXPERIMENTS AT ROTHAMSTED DURING 1925-1926

II—EXPERIMENTS WITH BASIC SLAG

Sir JOHN RUSSELL, D.Sc., F.R.S.,
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The Value of Basic Slag as a Fertilizer.—Two important problems connected with the use of basic slag have been studied : the crops on which it is best used and the value of knowing its solubility in the official 1 per cent. citric acid solution. Judging from our correspondence, and the questions asked at farmers' lectures given by our staff, these two problems are exercising the minds of agriculturists considerably.

The older experiments dealt mainly with the use of basic slag on poor grassland, and they showed the extent of the improvement that could be effected. In recent times, the position has altered considerably, because slag is no longer the same substance as it was ; it now includes at least three different kinds of material :—

(1) Bessemer slags, and those of similar type, containing phosphoric acid equivalent to about 40 per cent., tricalcic phosphate, 80 per cent. or more of which is soluble in citric acid.

(2) Open hearth slags, made without fluorspar, containing phosphoric acid equivalent to about 20 per cent. tricalcic phosphate, 80 per cent. of which is soluble in citric acid.

(3) Open hearth slags, in making which fluorspar has been used, containing phosphoric acid equivalent to about 20 per cent. tricalcic phosphate, 20-25 per cent. of which is soluble in citric acid.

All of these can, quite correctly, be sold as basic slag, but they have different agricultural properties and values.

The slags of the Bessemer type, formerly largely produced in England, now come in the main from Belgium, though some are still made in this country. They have high value as fertilizers.

The open hearth slags of the soluble and insoluble types are made in Britain; some are of considerable value, others are not.

These slags have been tested on swedes, meadow hay and permanent grazing land, and the tests have been made, not only at Rothamsted, but at other centres, as part of the work of the Permanent Basic Slag Committee of the Ministry of Agriculture.

Testing Basic Slag on Swedes.—These experiments were made at two centres: Andoversford in Gloucestershire and Stalybridge in Cheshire. The results were as follows:—

Phosphate	Analysis percentage		Yield per acre, tons	
	Total phosphate	Solubility	Andoversford	Stalybridge
None	—	—	8·3	18·5
Slag:				
Low soluble ..	22·41	37·3	9·6	18·6
Medium soluble	20·51	60·9	10·8	19·6
High soluble ..	20·56	86·8	11·1	20·8
Superphosphate ..	—	—	11·7	—
Standard error %	—	—	2·5	2·8

The experiment at Andoversford was made with the efficient help of Mr. Comely, and, at Stalybridge, of Mr. Reeves.

The experiment was carried out on the modern lines now adopted at Rothamsted, each treatment being repeated four or five times and the plots being "randomized" in proper statistical fashion. The extent to which the figures can be trusted is therefore known and, in point of fact, the figures are very trustworthy. The experiment shows that the low-soluble slag has no value at Stalybridge and only little value at Andoversford, while, at both centres, the medium-soluble slag is better and the high-soluble best. Superphosphate was tested only at Andoversford and it exceeded even the best of the slags in effectiveness.

Testing Basic Slag on Meadow Hay.—An experiment on new meadow hay was made at Brooke, Norfolk, and on old meadow hay at Enmore, Somerset. In neither case was it possible to obtain so accurate a result as with swedes, owing

to the circumstance that the crop is a mixture and not a single one. The new hay, however, being from newly-sown seed, was more uniform than the old and therefore gave less variable results ; the standard error for the new hay was 5·4 per cent., while for the old hay it was 7·1 per cent.

The results were as follows :—

Treatment	Hay, yield per acre			
	Brooke (Temporary grass)		Enmore (Permanent grass)	
	Tons	Per cent.	Tons	Per cent.
Control	2·28	100	1·37	100
Slag : Low soluble ..	2·28	100	1·49	109
Medium soluble	2·31	101	1·59	116
High soluble ..	2·65	116	1·53	112
Standard error per cent.	5·4		7·1	

As with swedes, the low-soluble slag had no effect in the drier Norfolk conditions, but it was somewhat effective at the moister Somerset centre.

These results show how greatly climatic conditions influence the effectiveness of slag ; this is seen better when the percentage increases in crop are collected.

SUMMARY OF ARABLE RESULTS
PERCENTAGE INCREASE IN CROP GIVEN BY DIFFERENT SLAGS

	Moist Conditions		Drier Conditions		Mean of all
	Andovers-ford	Enmore	Staly-bridge	Brooke	
Low soluble ..	16	9	Nil	Nil	6
Medium soluble.	29	16	5	1	14
High soluble ..	34	12	12	16	20
Standard error..	2·5	7·1	2·8	5·4	

It appears, therefore, that farmers in the Eastern Counties, under low rainfall, should use only high-soluble slags, while farmers in the West, under high rainfall and moister conditions, generally, may use low-soluble slags provided they can obtain them at sufficiently low prices. Even here, however, high soluble slags are more effective.

Bringing together the whole of the results on basic slag, it appears that the slag of low solubility is different in its nature from that of high solubility, and can never be made to give quite the same results, however much is applied. This important

fact has only recently been realized, and it explains many apparent discrepancies of earlier work. It had always been assumed that the low and high soluble slags were similar in their essential fertilizer action, but differed only in that the low-soluble slag contained less of the fertilizing material and need only be applied, therefore, in proportionately larger amounts to give the same effect as the high soluble slag. This point was tested on old meadow hay at West Tower Field, Cockle Park, by the staff of that farm : the mean results for the three years 1923, 1924 and 1925 were (in cwt. of hay per acre) :—

		Gain from the extra 5 cwt. slag
Control	14·1	—
Low soluble slag (22%), 5 cwt. per acre ..	17·3	3·2
„ „ „ „ 10 „ „ „ ..	18·7	1·4
High „ „ (42%), 5 „ „ „ ..	21·1	7·0
„ „ „ „ 10 „ „ „ ..	28·1	7·0
„ „ „ „ 5 „ „ „ .. + ground lime, 10 „ „ „ ..	25·6	—

This result is very interesting. For the low soluble slag, the first 5 cwt. increase the yield by 3·2 cwt. of hay ; the second 5 cwt. give only an additional 1·4 cwt. For the high-soluble slag, the first 5 cwt. give an additional 7 cwt. of hay, while the second give a further 7 cwt.

The conclusion is that the low-soluble slag differs not only in the amount but also in the kind of its action from high-soluble slag, and, however much were used, it would not come equal to the high soluble slag.

Recognizing the difference, we can now proceed to find what purposes the low-soluble slags can best serve. As far as experiments have gone they have these properties :—

(1) Under moist conditions they increase the yield of crops, but not as much as high-soluble slags would do.

(2) There is some indication that their effect lasts longer than that of high-soluble slags, so that in the second and subsequent seasons there is less difference between them and the high soluble slags than in the first season : this point, however, requires further testing.

(3) They seem to differ not only in the amount of their action, but in the kind of action, and it would be interesting to see how a mixture of low and high grade slags, or a mixture of low-grade slag and superphosphate, would behave.

Fine Grinding of Slag.—One obvious suggestion for improving the value of a low-grade slag is to grind it more finely. This

was tried, with the assistance of Mr. Comely, at Brockhampton, where the soil is a light limestone on the Oolite; the basal dressing was 1 cwt. each sulphate of ammonia and muriate of potash, applied early in June, but no dung was given; phosphates were given at the rate of 14 lb. phosphoric acid (P_2O_5) per acre on May 13. Swedes were drilled on June 5 and lifted on December 29. The yields were :—

	Swedes Tons per acre	Per cent.
No phosphate	2·5	100
Slag, low soluble, normal grinding (100 mesh) ..	7·8	335
„ „ extra fine „ (180 mesh) ..	6·7	289
High soluble	13·5	590
Superphosphate	15·3	658

The figures show that the extra fine grinding has not improved the low-grade slag; on the contrary, it has rather spoiled it. The experiment was also tried on mangolds at Leadon Court, and a similar result was obtained. The simplest explanation is that some constituent of the low-grade slag is harmful to plant growth, and its effect is intensified (as would be expected) by fine grinding.

General Conclusion.—The general conclusion of all the experiments with slag on arable land and hay land, and of those made in pots, is that solubility is a useful guide to the farmer in selecting basic slag. A high soluble is almost always more effective than a low-soluble slag.

Among the high-soluble slags (above 70 per cent.), however, the solubility is not a complete guide, for a slag of 75 per cent. solubility may prove better than one of 85 per cent. solubility. Presumably, the other constituents play a part in determining the fertilizer action.

For slags of less than 60 per cent. solubility, the solubility is a fairly safe guide to effectiveness. In moist conditions the low-soluble slags have more value than in drier conditions.

Basic Slag and Grazing Experiments with Sheep.—These experiments were carried out at Rothamsted, Thrussington in Leicestershire, and Fiddington in Somerset, as part of the work of the Permanent Basic Slag Committee of the Ministry of Agriculture. Both at Rothamsted and Thrussington the high-soluble slag usually acted well, though the relation between solubility and effectiveness was not as sharp as for the arable crops, one or other of the slags always coming out of its order. It is not possible to say whether the apparent exceptions result from some other property of the slag or from inequalities in the herbage or in the sheep. The Gafsa phosphate was

ineffective, as, also, was the slag of 28 per cent. solubility; a 35 per cent. soluble slag at Leicester also gave a good result out of place in its series, suggesting the possibility of accident, error, or some unknown factor. The results have been :—

ROTHAMSTED
Series I.

Total Phosphate Per cent.	Solubility Per cent.	Live weight increase in sheep: Total, lb. per acre: 1st 4 years 1921-24	Live weight increase in sheep: Total, lb. per acre: 5th & 6th years 1925-26	Live weight increase in sheep: Per cent.: 1st 4 years 1921-24	Live weight increase in sheep: Per cent.: 5th & 6th years 1925-26
Control		427	271	100	100
18·0	81·3	423	276	99	102
42·5	77·2	479	299	113	110
19·8	70·9	583	293	139	108

Series II.

Control		496	298	100	100
19·8	70·9	635	360	128	121
21·1	27·7	510	291	103	97
Gafsa		492	303	99	102

THRUSSINGTON

Particulars of slag: Total phosphate Per cent.	Particulars of slag: Solubility Per cent.	Live weight increase in sheep lb. per acre: 1925 4 sheep per acre	Live weight increase in sheep lb. per acre: 1926 6 sheep per acre	Live weight increase in sheep lb. per acre: Sum	Hay removed cwt. per acre
Control		133·8	217·0	350·8	3·0
19·31	82·7	164·6	267·0	431·6	6·0
20·98	63·3	166·9	207·7	374·6	5·5
26·61	49·9	145·3	216·1	361·4	5·25
20·51	35·0	158·4	260·7	419·1	3·5
Gafsa (55·7	total)	157·5	212·3	369·8	5·5

At Fiddington, Somerset, the slags did not increase the output of mutton from the land; on the contrary they lowered it, so that the unmanured land came out best. This remarkable result was obtained because the land was not sufficiently closely grazed; in consequence the grass grew away from the sheep and became coarse and innutritious. The old saying, common among the Leicestershire graziers, that "grass grown

in May must be eaten in May " is very wise, and embodies the profound truth that young herbage is more nutritious than old. It seems clear that farmers should not slag more land than they can properly graze or hay.

The grazing results, taken together, have brought out the interesting fact that land, capable of yielding in its unmanured state about 200 lb. live weight increase per acre in sheep, is difficult to improve by slag, while land, which without manure gives only 50 lb. or less, may be considerably improved so as to give 100 or 120 lb. Farmers who have seen these poor lands changed completely by slag must not think that better grassland will respond equally well. Other means must be sought for improving this.

The results for all centres are as follows :—

Centre	Live weight increase lb. per acre				Number of sheep carried per acre			
	1925		1926		1925		1926	
	No manure	High soluble slag	No manure	High soluble slag	No manure	High soluble slag	No manure	High soluble slag
Fiddington ..	242	212	187	93	6·5	6·5	6·3	6·3
Thrussington ..	134	165	156	225	3·8	3·8	6	6
Rothamsted ..	81	103	190	196	6·6	6·6	6·1	6·1
Hebron ..	53	123	18	71	2	4	2	4
Cockle Park ..	22	113	—	—	1·3	3·6	—	—

Degree of Trustworthiness of the New Field Experiments.—The new method of making field experiments used throughout at Rothamsted in 1925 and 1926 is not only more accurate than the older ones, but it allows an estimate of the magnitude of the error. Some of the experiments recorded in Parts I and II of this article had the following standard error.

STANDARD ERROR, PER CENT., 1926

Oats, total produce	1·4
straw	0·76
grain	2·78
Malting barley	4·5
Potatoes, quantitive set	1·92
quantitive set	5·5
Swedes	2·5
Meadow hay, new sown	5·4
old	7·1

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FURTHER OBSERVATIONS AND EXPERIMENTS ON THE CONTROL OF LIVER FLUKE

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FOLLOWING severe outbreaks of liver rot in Mid and North Wales, the senior writer and his collaborators have given considerable attention to the life history, bionomics, and control of the small fresh-water snail, *Limnaea truncatula*, which act as the chief intermediate host of the liver-fluke in this country.*

As regards control in the field it has been found that copper sulphate applied as a spray, as a dust, or broadcast when mixed with sand, proved effective in killing the snails, and this method has been used in a considerable number of cases.

One point, however, remained obscure in this connexion, and has been the subject of query by numerous sheep owners and others, namely: Are the eggs of these snails destroyed by such applications of copper sulphate? Experiments just concluded now enable this point to be cleared up and answered in the affirmative. The senior writer has also been asked on very many occasions such questions as: "Does drought kill the eggs?" "What is the effect of frost on the snails and on their eggs?" and so forth. Whilst able to answer such queries in a partial manner, the actual experimental evidence was either not available or was incomplete. These points also have been cleared up to a large extent, and are now dealt with.

The Eggs of Limnaea truncatula.—This species is self-fertile and consequently a solitary individual can repopulate a ditch or similar piece of water. Oviposition commences early in the spring, usually in March, and under suitable conditions continues throughout the summer. Each snail would appear

* [1] Walton, C. L., *Parasitology*, x, 2, 1917.
[2] ,, ,, U.C.N.W. Dept. of Agriculture, 1922.
[3] ,, ,, this JOURNAL, May, 1922.
[4] ,, ,, this JOURNAL, August, 1923.
[5] ,, ,, U.C.N.W. Dept. of Agriculture, Advisory Leaflet, 1922 and 1926.
[6] Walton, C. L., and Jones, N. W., this JOURNAL, November, 1925.
[7] ,, ,, *Parasitology*, xviii, 2, 1926.
[8] Walton, C. L., and Rees Wright, W., *Parasitology*, xviii, 4, 1926.

to deposit several masses of ova, the number of eggs in each mass varying considerably, ranging in our experience from 1 to 28. Details of a hundred masses recently tabulated gave a mean number of 15·7 ova per mass; these masses were deposited by snails to an average height of 10mm. A previous count of 20 masses from smaller snails averaged 9·75 ova. The mean size of masses from the large snails was 5·6mm. × 3·9mm., the smallest being 4mm. × 3mm., and the largest 8·5mm. × 4·0mm. (It may be noted that this unusually large mass contained only 14 eggs.) The masses are usually roughly ellipsoidal in shape when deposited on mud, but when placed on dead leaves, etc., the surface of attachment is markedly flattened. When deposited they are clear and gelatinous, but rapidly become coated with mud, etc. The average hatching period is about three weeks, but naturally varies with temperature and other conditions. The eggs being thus embedded in a gelatinous mass, it has been argued that they would not of necessity be reached and destroyed by more or less dilute solutions of copper sulphate.

Effects of Copper Sulphate on the Eggs.—Experiments were therefore conducted to determine this point. Egg masses in all stages of development, both free and attached to leaves, were placed in dishes. Some were treated with copper sulphate solutions of various strengths, whilst a number were left as controls. The details of the experiments were as follows :—

Copper sulphate solution, 1 per cent. : 18 masses in various stages were placed in each of three dishes, A, B and C. A and B were treated with the solutions for periods of 24 and 48 hours respectively, C remaining untreated. In A and B all the eggs became opaque in varying degrees, and failed to hatch, whereas in C the hatching rate was normal. Further experiments were then carried out on these lines, using solutions of $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{10}$ per cent. respectively, with similar and equally successful results; the controls in each case hatched normally.

Desiccation of Eggs.—Drought has proved to be the chief natural controlling factor both for the adult snails and for their eggs. The senior writer had previously carried out some experiments (Walton,[1] 1917); the ova masses, when removed from water, or allowed to desiccate naturally, were found speedily to dry up and then resemble a hard and inconspicuous scale. On re-immersion they speedily resumed their former size and shape, and in some cases hatched after periods of desiccation ranging from 36 to 100 hours. This matter,

however, was left in an unsatisfactory state, and has now been re-examined.

Egg masses attached to leaves were placed in dishes, some being allowed to dry, whilst others were kept as controls. It was found that whether the masses were dried in the laboratory or in the open air (protected from rain) that eggs of all stages of development could resist desiccation up to twelve hours, whilst eggs about to hatch withstood 24 hours' drying. These results are not strictly concordant with those obtained in 1917, but it is obviously impossible, with experiments of this nature, to ensure that all factors are exactly consistent on different occasions.

Freezing of Eggs.—Several trials were made to determine the effect of freezing on egg-masses. The eggs were placed in vessels containing water, which were surrounded by a freezing mixture of ice and salt. The water was allowed to freeze to a solid mass, and to remain in this condition for about three hours, and then melt gradually. In no case was the death rate found to be other than normal, a majority of the eggs hatching in due course.

Experiments and Observations on Snails: *Desiccation of Snails.*—The seasonal fall of water level (which usually occurs during spring and summer) exposes the Molluscan inhabitants of shallow waters to numerous enemies and adverse conditions. The senior writer has already discussed this matter as follows: "Direct observation in the field, and laboratory experiment, have both amply proved that the snails can resist drought for a relatively short time, though the time necessary to cause death depends upon both physical and meteorological factors which are very variable." (Walton,[1] p. 251.) "If the land was bare and level, death speedily took place, but where there was long, dense vegetation, or shade of any kind, up to 30 per cent. of the snail population survived right through the drought. . . . The most favourable conditions for the snails prevailed on heavy soils, which had been trodden into deep holes by horses and cattle during the winter and spring, so that holes were left which were frequently from four to six inches in depth and retained the form of the hoof, thus forming more or less overhanging and cavern-like pits." (Walton,[2] 1922.)

During October, 1925, a considerable number of farms in North Wales in all types of country were examined for *Limnaea truncatula*. As a result it became evident that an

enormous reduction in the snail population had taken place since the spring; and, as after the drought of 1921, the reduction was most notable in those situations where the snails had been previously most abundant, that is to say, in shallow waters on heavy or clayey soils. On many of these —including some on which sheep were infected in a wholesale manner, and where sheep actually remained heavily infested with fluke and under treatment—*L. truncatula* had almost disappeared. It nevertheless remained apparent that a few individual snails always survive to continue the species; for if careful and prolonged search be made, isolated snails could almost invariably be discovered, preserved by some exceptional circumstance. Recent research (Walton and Jones[6]), has shown how these few survivors may perpetuate the species. It is also notable that more survivors could be found in the normally less favourable environments (such as certain peaty lands or clays overlaid by, or adjacent to, peat, and especially at higher elevations), than in those which were actually optimum earlier in the season.

A series of experiments bearing on these points has recently been carried out by the Agricultural Department at Bangor, using a wooden trough 3 ft. 7 in. long, 2 ft. 7 in. wide and 4 in. deep (inside measurements), which was placed on the flat roof of the buildings and supplied with mud, water, vegetation, and snails brought direct from a natural field environment. This proved very suitable for the snails, which lived there for several months in a healthy condition. Drought conditions commenced on April 15, 1927, and all water had disappeared by April 18, although the hollows in the mud were still damp. The species utilized were *Limnaea truncatula*, *L. pereger*, *L. palustris*, *Aplexa hypnorum*, and *Planorbis spirorbis*. Samples of snails were collected daily and placed in water for 48 hours, two counts being made, one after 24 hours and the second after 48 hours. The results are given in the table appended, and indicate the relatively greater resistance of *L. truncatula* as compared with the other species employed.

Freezing of Snails.—Repeated trials were made to test the effect of frost upon snails, both under natural and under artificial conditions. In these trials, in addition to *L. truncatula*, the species already listed were included, all of them being locally abundant, and frequently inhabiting the same or nearly adjacent environments. All were exposed to frost,

NATURAL DESICCATION EXPERIMENTS WITH *Limnæa truncatula* AND OTHER SPECIES.

Date 1927	No. of snails examined	Weather conditions	Result
April 18-19	A. 20 (various) from dampest hollows B. 20 from driest areas.	Hot sun ; calm. Temp. Max. 77°F Min. 51°F	A. 6 *truncatula*, all alive. 7 *pereger*, 4 alive, 3 dead. 5 *palustris*, all alive. 2 *Aplexa*, dead. B. 16 *truncatula*, 1 alive, 15 dead. 2 *palustris*, 1 alive, 1 dead. 2 *Aplexa*, dead.
20-21	A. 30, dampest hollows. B. 25, driest areas.	Dull, cloudy, cold dry west wind. Temp. Max. 52°F Min. 52°F	A. 18 *truncatula* alive. 3 *pereger* 1 *palustris* 5 *Aplexa* 3 *Planorbis* } all dead. B. 16 *truncatula* 7 *pereger* 2 *Planorbis* } all dead.
21-22	A. 50, dampest hollows. B. 50, driest areas.	Bright sun, strong west wind. Temp. Max. 69°F Min. 59°F	A. 22 *truncatula* alive, 15 dead. 2 *palustris*, 1 alive, 1 dead. 1 *Aplexa*, dead. B. 28 *truncatula* alive, 10 dead. 7 *pereger* 1 *palustris* 2 *Aplexa* 2 *Planorbis* } all dead.
22-23	A. 50 dampest hollows. B. 30, driest areas.	Very strong dry west wind, sun intermittent. Temp. Max. 79°F Min. 56·5°F	A. 12 *truncatula* alive, 34 dead. 2 *pereger* 2 *Aplexa* } dead. B. 8 *truncatula* alive, 14 dead. 2 *pereger* 3 *palustris* 1 *Aplexa* 2 *Planorbis* } all dead.

After April 23 showery weather set in, and the experiment was abandoned. The relative resistance of *L. truncatula* is evident.

mixed together in the same vessels. In some cases they were in shallow water only, in others they were placed on mud under water. The results obtained were by no means uniform. In the case of *L. truncatula*, for example, two identical experiments, carried out on the same day, gave recovery rates of 50 and 100 per cent. respectively. As regards the other species, the results were equally vague, except in the case of *Planorbis*, which invariably succumbed.

These results met the expectation of the writers, since previous observations in Mid and North Wales on ditches

inhabited by numerous *L. truncatula* showed no appreciable difference in population after severe frosts lasting several days. *L. truncatula* is of frequent occurrence in waters so shallow that it cannot fail to become frozen on numerous occasions during any normal winter. It may be remarked, however, that artificial freezing experiments with newly hatched snails of *L. peregèr* and *Aplexa* gave 100 per cent. death rate.

Summary.—(1) Egg-masses of *Limnaea truncatula* are killed by very dilute solutions of copper sulphate.

(2) Under laboratory conditions, desiccation for more than twelve hours was fatal to egg-masses in all stages of development.

(3) Under laboratory conditions, freezing appeared to have no effect on egg-masses.

(4) *L. truncatula* show very considerable natural resistance to freezing,: evidently frost cannot be relied upon as an aid to the clearance of ditches or pastures.

(5) *L. truncatula*, although killed by direct desiccation, resisted drought longer than other species living with it, and under certain circumstances survived for considerable periods.

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MARKETING OF EGGS AND POULTRY

STANDARDIZATION: PRINCIPLES AND POSSIBILITIES*

Standardization has been described as the first principle of modern commerce, the movement from the indefinite to the definite. The spirit of order that standardization implies is already spreading over many of the industries that together make up the great industry of agriculture, and, in a number of countries, there are examples of the successful application of a standardization policy that reaches back to production, and forward—through classification, grading, packing, packages and methods of selling—to what is known in America as "orderly marketing," with its attendant advantages in the sphere of distribution.

Hitherto, standardization has largely, though not wholly, achieved its most notable successes when applied to agricultural products that are the subject of international trade, but there

* Paper contributed by Mr. A. W. Street, C.I.E., M.C., Ministry of Agriculture and Fisheries, to the World's Poultry Congress, Ottawa, July, 1927.

is evidence of a gradual movement towards the standardization of commodities that meet a wholly domestic demand and have no market abroad. This trend is indisputable, though it varies in degree with different countries and with different commodities. Indeed, if a little crystal-gazing may be permitted, it seems safe to predict that, under the pressure of competition, the deliberate standardization of agricultural products, in the mass, is inevitable over the whole marketing field. The reason lies mainly in the superior economy of standardization; it saves time and effort and, therefore, money.

(1) Relation of Production to Economical Marketing.—In the market place, the product of one farm mingles with that of another—this breed with that breed, this variety with that variety, this type with that type, this cross with that cross, this nondescript with that nondescript, the large with the small. If a uniform product is to be distributed, someone, somewhere, must sort these diverse supplies; but it is obvious that if producers would agree to standardize their production types they could, to some extent, diminish this service and reduce its cost. This is an obvious and first step towards better and cheaper marketing. It involves the planning of production in terms of areas rather than of individuals; it simplifies marketing.

There are examples which show the advantages to be obtained when a large proportion of producers over a wide area concentrate on the type best suited to local conditions of soil and climate—the Heathfield district of Sussex in England (where the fowls known in the trade as "Surreys" are mostly produced), the Malines district of Belgium ("Poulets de Bruxelles") and the Vendée and Bresse regions of France ("Poulets Nantais" and "Poulets de Bresse"). Mention might also be made of the district of Barneveld in Holland and of parts of Deux Sèvres in France, where the production of brown eggs is the main objective.

The importance from a marketing standpoint of this group or community production of more or less uniform types is gradually gaining recognition among producers of all farm commodities. Standardization begins on the farm.

(2) Standardization of Classes, Grades and Packages.—Although, by the concerted action suggested above, it is possible for poultry keepers over wide areas to approach uniformity in their product, grading to varying degrees of refinement will always be desirable, since there will always be

differences arising from natural causes and from differences in farm practice. In fact, the specific uniformity that is desired by the trade can only be obtained first by classification, according to some fixed characteristic such as weight, and then by quality grading, according to such attributes as freshness for eggs, or condition, colour of skin, conformation and so on for table poultry. The importance of this arrangement of products into groups with common characteristics is manifest. It is not, however, sufficient that produce should be efficiently graded according to the systems favoured by this producer or that producer, by this merchant or that merchant; it is essential that one schedule of classes and grades should be operative over the whole country, and one only, and that this should be designed explicitly to meet the demands of the market. In short, classification and grading, though always in themselves important, only assume their real significance when the classes and grades are standardized.

Standardized grading provides a basis for a national system of selling in which inspection need not invariably precede purchase; it furnishes a common language for buyers and sellers, makes possible the accurate determination of values and the quotation of comparable market prices, minimizes disputes, encourages long-period contracts, and, in general, facilitates direct sale at assembling points in producing areas to distributors in distant consuming centres. This means increased efficiency and a corresponding reduction in costs. It also facilitates the financing of such operations as storage.

The standardization of methods of packing is, perhaps, of less importance for poultry produce than for some other commodities, such as fruit. The standardization of containers, whether cartons, boxes, hampers, crates or baskets, is, however, of considerable importance to the poultry industry. It is obvious that if one or two types of packages be selected as best adapted to trade requirements (in such matters as attractiveness—where this is a consideration—size, convenience of handling, prevention of damage to contents, storing and economical transportation), and these types alone are manufactured, not only are cheaper packages possible, but the quantity element is standardized.

Thus standardization reduces the marketing costs of the producer. It also opens the way to fundamental marketing reforms; it is a step towards organized marketing, the pooling of supplies and the adoption of mass selling methods—which

include advertising and the control of the daily flow of supplies to market.

(3) **Organization.**—Experience the world over shows that, for various reasons, some form of organized marketing is desirable if the continuous supply of a standard product is to be provided and maintained. This applies particularly to table poultry; only in exceptional cases can the table-poultry producer, as an individual, supply a standard product continuously and in bulk; the systematic conditioning of birds for market can rarely be conveniently and economically carried out by individual farmers. It is also true of eggs, in the sense that the pooled contributions of a large number of suppliers can be more cheaply and effectively tested, graded, packed and sold than the limited output of a single farm. This is not necessarily a plea for producers' co-operation as the term is generally understood. It is, however, a plea for the establishment, in the areas of surplus production, of efficient assembly organizations which can undertake the standardization of bulk supplies for market. How this organized assembling finds expression, whether through country dealers working on their own account, through independent undertakings operating in an agency capacity on behalf of producers, or through producers' co-operative organizations, depends on circumstances, and is not of such immediate importance as the realization by producers that the lack of organized assembling means, for their industry, excessive internal competition and a wasteful marketing system generally.

(4) **Constructive Possibilities.**—In the poultry industry, as in other agricultural industries, standardization leads naturally, therefore, to the establishment of large business units in the assembly field. There are already interesting examples of this in a number of countries. If, for any reason, producers are not disposed to capitalize the tendency, others will do so. These combinations, however constituted, when brought gradually into relationship and agreement one with another, will be in a position so to work together that, through them, the poultry industry *as a whole* will be able to undertake the collective study of the market, to choose and carry out a marketing policy, and, what is of paramount importance, to bring production into harmony with it; this is impossible while marketing remains unorganized.

Ordinary commercial vision will reveal the directions in which the co-ordinated industry can then best move. One direction

will, doubtless, be towards central selling to distributors, which may take the form of collective bargaining or the conduct of agency sales. Other directions may be towards the mitigation of internal competition by the allocation of markets, and towards the balancing of supply and demand—both by the studied diversion of produce according to the types and qualities desired by particular markets and by the determination of the time and rate of marketing supplies. This presumes also a correlated programme of cold storage and other methods of conservation. Finally, when sales are slow or supplies are heavy, an industry that has standardized products to sell will be able to advertise to advantage ; modern advertising is expensive and frequently can only be worth while when applied to standardized products.

(5) The Distributor's Position.—The standardization of products increases the speed with which business can be conducted—a merit of particular importance for perishable produce. It means less risk for the distributive trade. For these and other reasons that are apparent, it costs less to buy and sell a standardized than an unstandardized product. Further, the growing preference of the consumer for standard products, coupled with the ease with which demand can be influenced and established in their favour by means of trade names, brands and marks, promotes increased turnover, which, again, means cheaper selling. Viewed in this light, the organized assembling of produce in the areas of surplus production for the purpose of standardization becomes an aid and not a rival to the distributive trade ; it may lead to the consolidation of buying interests and, in some instances, to the integration of assembling and distribution ; it would certainly attract capital into agricultural marketing.

(6) Consumer-demand.—The force which has helped many standardization programmes to success is the imperiousness of consumer-demand. The consumer increasingly expects dependable quality with little or no waste ; the convenience of " repeat orders " is valued. On these counts, standard products give unchallenged satisfaction to which the consumer promptly reacts ; further, and this is of importance from the standpoint of the consumer, the prices of standard products can be easily and reliably compared.

There is no doubt that in the table-poultry industry, a standardization policy, by instilling confidence, would work

wonders in the stimulation of consumer-demand. In the egg industry, Canada, appropriately enough, affords an interesting example. Grading to recognized standards improved the export trade and led to the adoption of the system for the domestic market. What has been the result? Consumers have so reacted to better value that the estimated consumption of eggs per head in Canada is said to have increased by nearly 50 per cent. in the few years since the reform was introduced. After all, the object of production is consumption.

(7) **Conclusion.**—Standardization all along the line is one of the most promising and constructive ways of reducing the spread between producers' and consumers' prices, and of diminishing the fluctuations which at present characterize both. It is even probable that savings greater than those possible in any other direction are to be obtained by *the production and marketing of standardized products*. The marketing reforms that have been introduced in some countries, and that are being urged in others, are important elements of a standardization policy; they show the way in which the poultry industry is already moving in some countries and will eventually move in all. The responsibility of recognizing the inevitability of standardization rests with the leaders of the industry. It is their duty so to guide the impulse towards it that the industry may move smoothly and securely forward to this end.

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POULTRY KEEPING IN FRUIT PLANTATIONS

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IN the July, 1920 (Vol. XXVII, No. 4), issue of this JOURNAL the writer gave an account of the financial results obtained by a successful Kent small-holder and his son—Messrs. W. Hall & Son, of Grover Hill, West Peckham—during the war years, 1914-19. Careful accounts have been kept, year by year, since the termination of the war, and it may now be of interest to set out the results during the past seven years.

Mr. Hall's holding of 17½ acres is situated about nine miles on the Sevenoaks side of Maidstone and lies on the slope of a steep hill facing south, on the Lower Greensand formation, an ideal site for poultry. Of the 17½ acres, 4½ acres are under grass,

of which 2 acres are usually hayed to provide winter food for a horse and two cows. The remaining 13 acres are under fruit, 10 acres of cobnuts, with standard apples as top fruit, 2 acres of cobnuts alone, and 1 acre of young nuts with mangolds and potatoes grown between the bushes. No fowls are kept on the acre growing the young nuts. The poultry are confined in permanent runs on the other 12 acres devoted to fruit. The number of birds on the holding on November 1 of each year has averaged 750 during the past seven years, *i.e.*, approximately 60 birds per acre, latterly 70 birds per acre. Practically the whole of the work on the holding is done by Mr. Hall and his married son, so that two livings have to be earned from the poultry and from the fruit, the accounts for which are kept separate. Mrs. Hall (senior) and Mrs. Hall (junior) help with the gathering of the fruit and nuts, and a young man is employed for three weeks in the year to help with the pruning of the nuts. A married daughter also helped to gather the nuts in 1925. With these exceptions, nobody else has been employed on the holding. In the poultry account, no charge is made for rent, because the ground is fully cropped with fruit and the value of the birds' manure is estimated to be more than equal to any sum due as rent. Excluding any charge for rent, the accounts for the past twelve years have shown that a considerable sum of money has been available at the end of each season to pay for the labour of Mr. Hall and his son.

Year ending Oct. 31	No. of birds on holding at beginning of season		No. of eggs produced	Eggs per bird	Balance to pay for labour		
	Total birds	Hens and pullets			£	s.	d.
1915	152	138	15,111	109	104	1	8
1916	408*	140*	22,859	163*	141	6	7
1917	542	312	31,416	101	112	1	5
1918	224	205	22,052	107	237	11	5
1919	285	189	27,611	146	419	19	1
1920	518	394	42,605	108	697	18	5
1921	655	404	52,725	130	547	9	2
1922	716	458	62,171	136	487	10	7
1923	638	593	68,894	116	407	15	11
1924	875	795	82,607	104	410	4	3
1925	890	817	101,367	124	522	6	8
1926	954	823	93,383	113	605	13	10

* The total number of birds (408) includes 256 autumn-hatched chickens. Half of them were pullets (127) and several of them began to lay in the middle of January.

The number of eggs laid per bird is estimated by dividing the total number of eggs laid during the year by the number of hens and pullets on the holding at the beginning of the year.

Seven years ago several breeds of poultry were kept—White Wyandottes, White Leghorns, Buff Orpingtons, Light Sussex, and Rhode Island Reds—but now there are only two breeds, Rhode Island Reds and Light Sussex, many of the hens being first-cross.

Mr. Hall took up poultry keeping on a commercial scale for the first time in 1911, as the result of attending a course of lectures given by the County Council Instructor in Poultry-keeping, and he ascribes his success very largely to the instruction and advice he has received from time to time from the same source. On the average of the past seven years, there has been a balance of £525 a year to pay for labour. Mr. Hall and his son do practically the whole of the work on the holding themselves, and only a portion of their time—though much the greater portion, because the fruit trees receive very little attention—should be charged against the poultry. It is evident, therefore, that the poultry show a good profit.

Full particulars of the accounts up to October 31, 1919, were published in the July, 1920, issue of this JOURNAL, so that it is only necessary to deal here with the past seven years. In the valuations, cocks are valued every year at 4s. per head, cockerels at 5s., hens at 3s., and pullets at 5s. Houses and appliances are valued at the end of each year by taking the valuation figure at the beginning of the year, adding on any purchases made during the year, and deducting 12½ per cent. for the year's depreciation.

Sales of Eggs for Consumption.—The number of eggs sold for domestic purposes each year, with the average price per dozen, has been as follows :—

Season	No. of eggs sold	Average price per dozen s. d.	Total receipts £ s. d.
1919-20	26,283	4 1½	451 4 10
1920-21	42,830	3 0½	541 7 9
1921-22	55,081	2 3	527 18 5
1922-23	60,991	1 11	484 17 11
1923-24	77,269	1 11	618 12 6
1924-25	96,649	2 0	794 3 3
1925-26	89,223	1 11½	724 15 6
Total for seven years	**448,326**		**£4,143 0 2**
Average per annum	**64,046**	**2 2½**	**591 17 2**

Commissions and tolls have been deducted in the case of those eggs sold in Maidstone and Tonbridge markets. The prices realized have, of course, varied considerably from month

to month and from year to year. In 1925-26, first quality eggs averaged 3s. 4½d. per dozen in November, and 1s. 4d. per dozen in March and April. Second-grade and pullets' eggs averaged 2s. 8d. per dozen in December, and 1s. 2d. per dozen in March and April. The first pullets started laying on June 21 in 1926, and on July 24 in 1925.

Sales of Eggs for Setting.—Eggs were also sold for setting as follows :—

Season	No. of eggs	Average price per dozen	Total receipts
		s. d.	£ s. d.
1919-20	10,600	6 10½	303 19 10
1920-21	6,225	6 11	179 12 7
1921-22	4,138	6 5	110 7 8
1922-23	3,314	5 5	74 11 5
1923-24	1,987	4 11	41 0 1
1924-25	1,345	5 2	28 19 11
1925-26	699	5 6	15 19 5
Total for seven years	28,308		£754 10 11
Average per annum	4,044	6 5	107 15 10

Sittings are sold each year at a definite price each, a sitting consisting of 12 eggs if they have to be despatched or 13 eggs if they are called for. The cost of carriage and packing has been deducted in the above table.

Sales of Eggs under Ministry's Distribution Scheme.—Messrs. Hall & Son have acted as a Station Holder under the Egg Distribution Scheme ever since its inception and, in addition to the eggs already mentioned, have sold the following number of sittings under the scheme :—

Season	No. of eggs sold	Average price per dozen including Government grant	Total receipts
		s. d.	£ s. d.
1919-20	2,652	8 0	88 10 0
1920-21	1,334	9 0	50 0 6
1921-22	833	8 0	27 15 4
1922-23	876	7 0	25 11 0
1923-24	1,057	7 0	30 16 5
1924-25	1,173	7 0	34 4 3
1925-26	1,038	7 0	30 5 6
Total for seven years	8,963		£287 3 0
Average per annum	1,280	7 8	41 0 5

Hatching Results.—Infertile eggs were used at home and valued at 1d. each. The hatching results, each season, have been as shown in the next table :—

(a) *Incubator Results :*

Season	No. of eggs set	No. of eggs infertile	Chicks hatched	Percentage fertile eggs hatched
1919-20	600	70	373	70·3
1920-21		Figures not available		
1921-22	194	32	111	68·9
1922-23	2,661	360	1,607	69·8
1923-24	1,818	214	1,171	73·0
1924-25	2,189	252	1,545	79·7
1925-26	1,872	127	1,448	83·0
Total for six years	9,334	1,055	6,255	—
Average per annum	1,556	175	1,043	75·5

Three incubators are used, each incubator having a capacity of 160 eggs.

(b) *Hatching Results under Hens :*

Season	No. of hens set	No. of eggs set	No. of eggs infertile	Chicks hatched	Percentage fertile eggs hatched
1919-20	211	2,470	182	1,707	74·6
1920-21	173	2,016	168	1,463	79·0
1921-22	170	1,925	201	1,310	75·9
1922-23	89	1,052	116	742	79·2
1923-24	41	476	50	345	80·9
1924-25	1	11	0	9	81·8
1925-26	49	551	29	437	83·7
Total for seven years	734	8,501	746	6,013	—
Average per annum	105	1,214	107	859	77·5

In comparing the hatching results under hens with the incubator results it must be borne in mind that the incubators were started in January each year, whilst the hens were not set until about a month later.

The total number of eggs hatched during 1925-26, in incubators and under hens, was 1,885, of which 838 were sold as day-old chicks and 6 at six weeks' old, leaving 1,041 to be reared. Of this number 949 were in fact reared as follows : 347 sold as table birds, 49 sold as pullets, 27 cockerels, 2 table birds, and 524 pullets on the holding at the end of the year. The chicks were all reared in hovers, except about 120 reared with hens, and the losses were 92, *i.e.*, 9 per cent. Of the 1,041 to be reared, 638 (53 per cent.) were cockerels and 573 (47 per cent.) were pullets.

Birds of various ages have been sold at various prices or killed for home use, and a valuation price entered in the accounts.

Sales of Chicks under Ministry's Distribution Scheme.—In 1925-26, Messrs. Hall & Son sold 408 day-old chicks under the Egg and Day-old Chick Distribution Scheme at 14s. per dozen, including the subsidy, bringing in £23 16s. 0d. Every year they have sold a number of day-old chicks in the ordinary way at commercial prices as follows :—

Season	No. of day-old chicks	Average price s. d.	Total receipts £ s. d.
1919-20	1,088	1 7	85 6 4
1920-21	693	1 5½	51 17 4
1921-22	708	1 1¼	38 17 0
1922-23	1,092	0 10	44 13 11
1923-24	480	1 0	24 4 8
1924-25	134	1 2	7 14 9
1925-26	430	0 10	18 13 0
Total for seven years	4,625	—	£271 7 0
Average per annum	641	1 2	38 15 3

Expenses.—The chief expenses, apart from labour, have been food and appliances; as many of the appliances are home-made or home-repaired they have not cost very much. The cost of the food, including cockle-shell, consumed each year is shown in the following table. The cost of appliances, including depreciation at the rate of 12½ per cent. per annum on both the appliances in stock at the beginning of the year and the appliances purchased during the year, is also shown.

Season	Quantity of food consumed Cwt.	Cost of food £ s. d.	Cost of houses and appliances £ s. d.
1919-20	401½	383 8 0	7 4 2
1920-21	555½	411 10 6	6 12 10
1921-22	506½	286 16 3	11 16 0
1922-23	717½	322 11 5	34 4 4
1923-24	665	342 10 6	47 8 4
1924-25	797	409 1 7	48 13 0
1925-26	845	360 14 8	41 16 6
Total for seven years	4,489	£2,516 12 11	£197 15 2
Average per annum	641	359 10 5	28 5 0

The houses and appliances do not include consumable stores such as paraffin, creosote, straw, non-returnable chick and egg boxes, &c. The feeding is rather unusual. As an illustration of the kinds and quantities of foods used, the following table shows the purchases during the past year.

Cwt.		£	s.	d.
250	Cracked maize at 9s. 3d. (approx.)	116	0	10
127	Wheat points at 8s. 11d.	56	13	11
5½	Kibbled wheat at 13s. 6d.	3	14	3
2¾	Maize grits at 10s.	1	7	6
297	Middlings at 7s. 2d.	106	13	8
76¼	Meat meal at 15s. 9d.	28	9	6
36	Maize germ meal at 9s. 8d.	17	8	0
32	Bran at 5s. 11d.	9	9	9
9½	Stale bread at 10s. 8d.	4	15	11
14¾	Malt culms at 6s. 5d.	4	15	10
12	Steamed bone flour at 6s. 3d.	3	15	0
15	Cockle shell at 5s. 3d.	2	8	6
9	Flint grit at 3s. 6d.	1	11	9
1	Sussex ground oats at 13s. 3d.	0	13	3
¼	Damaged rolled oats at 10s.	0	2	6
¾	Wheat germ meal	0	6	7
¼	Wheat meal	0	2	6
849¼	cwt.	£358	9	3

An analysis of the accounts for the past seven years gives the following interesting figures :—

Season	Balance to pay for labour			Appreciation or depreciation in valuation			Cash surplus			Sales of produce			Capital invested		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1919-20	697	18	5	+ 15	6	4	682	12	1	1,094	4	11	189	4	9
1920-21	547	9	2	+157	2	3	390	6	11	977	3	3	204	11	1
1921-22	487	10	6	— 92	9	2	579	19	8	830	4	7	361	13	4
1922-23	407	15	11	+203	15	2	204	0	9	747	1	0	269	4	2
1923-24	410	4	3	+ 32	10	0	377	14	3	831	2	0	472	19	4
1924-25	522	6	8	— 1	0	10	523	7	6	1,002	10	8	505	9	4
1925-26	605	13	10	— 10	6	6	616	0	4	1,002	7	2	504	8	6

Messrs. Hall & Son avoid all extravagances in poultry houses and appliances. Most of the houses have been built to their own design, the favourite type for adult stock on free range being 20 ft. by 10 ft. with wooden floor, movable perches, and nest boxes to open from the outside. These houses have hopper windows and ridge ventilation, and will hold 120 birds easily on free range.

The 1925-26 accounts show that the poultry consumed 845 cwt. of food costing £360 14s. 8d., and the total number of eggs produced—either sold or used for setting at home—was 93,383. This works out at 0·93 pence, *i.e.*, less than a penny per egg for food, without making any allowance for the food that was used for rearing young stock. In the previous season 797 cwt. of food costing £409 1s. 7d. produced 101,367 eggs or 0·97 pence per egg for food. The number of eggs laid per bird was 113 in 1926, and 124 in 1925.

PROFIT AND LOSS ACCOUNT

November 1, 1925, to October 31, 1926

DEBIT

	£	s.	d.
Value of 51 cwt. of food in stock, November 1, 1925	26	7	3
Value of 954 birds in stock, November 1, 1925 :—			
18 Cockerels (1925) at 5s.	4	10	0
2 Cocks (1924) at 3s.		6	0
421 Hens (1924) at 3s.	63	3	0
51 Hens at 2s.	5	2	0
233 Pullets (1925) at 5s.	58	5	0
118 Younger pullets at 3s.	17	14	0
79 Young cockerels at 2s.	7	18	0
32 Late-hatched chickens at 1s.	1	12	0
	158	10	0
Value of houses, appliances, etc., November 1, 1925	319	11	3
Appliances purchased during the year	10	2	6
Paraffin, creosote, etc.	9	15	6
Stationery, subscriptions, stamps, etc.	2	16	1
Advertisements	1	5	11
Purchase of 2 stock cockerels	3	17	8
Purchase of 849¼ cwt. food	358	9	2
Balance to pay for labour	605	13	10
	£1,496	9	2

CREDIT

	£	s.	d.
89,223 Eggs sold for domestic purposes at 1s. 11½d. per doz. (approx.)	724	15	6
699 Eggs sold for setting purposes at 5s. 6d. per doz.	15	19	5
1,038 Eggs sold under Ministry of Agriculture's Scheme at 5s. per doz.	21	12	6
Ministry of Agriculture's grant at 2s. per doz.	8	13	0
430 Day-old chicks sold at 10s. 5d. per doz.	18	13	0
408 Day-old chicks sold under the Ministry of Agriculture's Scheme at 10s. per doz.	17	0	0
Ministry of Agriculture's grant at 4s. per doz.	6	16	0
Received for the loan of two hens for rearing chicks		2	6
Received for rearing chicks for two weeks after they were sold		4	0
156 Infertile eggs at 1d.		13	0
6 Cockerels, six weeks old, sold in May		9	0
2 Hens sold with some chicks		15	0
347 Young cockerels at 4s. 2d.	71	16	3
50 1926-hatched stock birds at 8s. 4d.	20	16	1
85 Young birds (autumn-hatched, 1925) sold for table, mostly in November and December, at 5s. 6d.	23	10	0
331 Old birds sold for table at 3s. 2d.	53	1	9
39 Stock birds sold at 6s. 9d.	13	4	6
31 Birds killed for own use at 2s. 3d.	3	11	8
4 Hen coops sold		14	0
55 Cwt. of food in stock, October 31, 1926	24	1	9
Value of houses, appliances, etc., October 31, 1926	287	17	3
Value of 928 birds in stock, October 31, 1926	182	3	0
	£1,496	9	2

NOTE.— No rent is charged in this account, the ground being fully cropped with fruit and nut bushes, and the value of the manure is estimated to be more than equal to any sum due as rent. The cost of attendance has not been included, as no actual figure can be given. Mr. Hall and his son do all the work themselves.

Summary.—It must not be expected that every poultry keeper could be as successful as Messrs. Hall & Son. Their case is undoubtedly exceptional. There are, however, many orchard and fruit plantations throughout the country which would produce larger crops of fruit, and better quality fruit, too, if poultry were allowed to have a free run under the trees. Poultry consume innumerable caterpillars and other fruit tree pests, and thus save the fruit grower much expense that would otherwise have to be entailed in grease-banding, spraying, etc. Moreover, if the land is first dug over, or if it has previously been kept under cultivation, the birds will, by their continual scratching, keep it free from weeds and will reduce the cost of cultivation, while their droppings will assist considerably in the manuring of the trees. There are also considerable advantages in the combination of poultry keeping and fruit growing from the point of view of the fowls. The cost of feeding the fowls is reduced appreciably during certain times of the year by the number of insects, usually regarded as pests, that they consume. Amongst the insects readily devoured by poultry may be included the caterpillars and wingless females of the winter moth, the larvae of the codling moth, pug moth and pear midge, slugworms, wireworms, leather jackets, surface caterpillars, the raspberry and many other weevils, aphides, etc. Unfortunately they are useless for the control of fungus diseases.

Space prohibits the publication of the complete Profit and Loss Account for each season, but a summary of the 1925-26 Profit and Loss Account is given on the preceding page.

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NOVEMBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

Seasonal Notes.—November is in the autumn quarter of the astronomer's year, the beginning of winter being reckoned from December 21. In the farmer's calendar, however, this month belongs to the dead season, and the countryside in November wears an aspect more like winter than summer. The trees are nearly bare ; the hedgerows are now leafless and display their red berries ; the flowers have gone, and all that remains of the flowering herbs is their dead and shrivelled stalks. The pastures now begin to look grey—an appearance which will this year be emphasized by the quantity of long growth that has been

left unconsumed by the stock. Such few cattle as are still out of doors now carry long shaggy coats, which add to the wintry appearance of the fields.

There is often a gloomy silence in the November day, yet its reputation for windiness is well founded. Our Saxon ancestors called November the Wind-monath, owing to its storms, for fear of which they drew their boats ashore at this period and ceased fishing till next April. Fog-month is another appellation that has been aptly used, if only because of the misty evenings at this time of the year. On the average of long periods the rainfall of November is high, being exceeded only by October and December. For six years preceding 1926, however, the November rainfall in the Midlands had been light, and favourable to the completion of wheat sowing operations.

The chief farm date in November is the eleventh, St. Martin's Day or Martinmas. This is still a term day in Scotland and certain northern districts of England, and an indication of its former place as an important rural feast survives in the custom, still fairly common, of holding the estate rent audit and tenants' dinner on Martinmas Day. This custom probably dates from that of feudal times, when smaller land-holders paid Wroth-money to the Lord of the Hundred, who in return undertook their protection. The payment was made on this day and was followed by a substantial meal provided at the expense of the Lord of the Hundred.

Before farmers had root crops and concentrated foods for winter feeding it was necessary to slaughter cattle and swine at Martinmas; and, as only salt meat was available from then till next summer, the secular reason for feasting on this occasion is not far to seek. The association of St. Martin with conviviality, however, was probably derived from the fact that this day happened to coincide with the Roman Vinalia or Feast of Bacchus, an occasion when the new wines of the year were tasted.

Wheat Seeding.—Wheat may follow any crop in the rotation that allows of the land being prepared and sown at the proper season for wheat seeding. During the last few years, while oats have been relatively lower in price than wheat, the tendency has been to drill winter wheat at the expense of the acreage of winter oats. This tendency has been accentuated somewhat by the recognition of the fact that, whereas it is risky to delay the sowing of wheat till after the New Year, winter oats and

especially white winters are if anything favoured by not being sown until after the middle of January.

It is not easy to analyse the divergent views held as regards the best date for wheat sowing. Formerly one heard much of the risks of early sown wheat becoming winter-proud, but this trouble is not often met with, and indeed there is little likelihood of its occurring in ordinary practice, unless early sowing has been accompanied by too heavy seeding. There is, however, a belief that on the lighter classes of land the proportion of grain to straw is reduced by sowing too early. The difficulty is to know what date is not early enough to incur this risk without running the risks attaching to late sowing. November is a favourite month for wheat sowing on light land in the Midlands, but this contrasts with Continental practice, where September is preferred when conditions will allow of sowing so early. Differences in climatic conditions and varieties grown may account for these divergences in views, and usually local experience is the safest guide.

Certain sorts of wheat are better than others when sown late in the season. Early ripening varieties, "Little Joss" and "Squarehead's Master" or "Red Standard," are undoubtedly safer than late-growing kinds such as "Iron," "Iduna" and "Rivett's"; and this preference is not induced by considerations of the time at which they will be ready to harvest next season, but by the experience that they are less liable to die away in the winter than are those of later habit.

In drilling wheat it is generally best to draw the rows from north to south, as this allows of the sun's rays reaching the bottom of the plants. Three bushels per acre is the standard quantity of seed for November sowing, but the actual quantity required will vary with the size and viability of the sample of seed and the nature of the land. This rate of seeding, if every seed germinated, would give two to three seedlings per inch in six-inch rows. That the seedlings do not come up so thickly is due not only to the depredations of birds and soil pests, but also to drilling too deeply, dressing with injurious preparations, and excess of soil moisture.

The possibility of poor germination after a bad harvest was mentioned in the September notes. Many farmers, however, impair the germinative energy of their seed wheat by pickling it in too strong solutions of copper sulphate: the old dressing of ½ to 1 lb. per gallon of water has been found to destroy 25 to 30 per cent. of the seed and to delay the germination of that which survives by one to two weeks. Formalin has been preferred

for dressing. The most recent proposal is that of using finely-powdered copper carbonate in its dry state. This has been found to be non-injurious to germination and, if thoroughly mixed with the seed, satisfactory as a preventive of stinking smut at any rate, when the seed grain is not heavily contaminated with spores. The quantity required is ½ lb. per sack of wheat.

Winter Barley.—With the improvement in the price of barley, some farmers have inquired as to the wisdom of drilling "Archer" or other hardy variety of two-rowed barley in this month. It is well known that barley of the malting types, as distinct from the six-rowed winter sorts, can be sown with success in autumn; but there is little practical evidence that it is better to sow in autumn than in spring. Indeed, the results of the following experiment conducted in Devonshire on light loam, where winter sowing might have been expected to succeed if anywhere, do not favour autumn sowing.

	Sown October 13, 1923. *Yield per acre.* *Bushels.*	*Sown March* 14, 1924. *Yield per acre.* *Bushels.*
Plumage Archer	30	42
Spratt Archer	28½	39¾
Plumage	26½	36
Archer	26	38
Maltster	20	37

In the annual report of the Botanist to the R.A.S.E. for 1926 are recorded a number of observations on the results of sowing barley in the autumn months of 1925. Not only were there frequent failures to secure a plant, even on light soils, but the ears of the plants were badly affected with blindness.

Live Stock.—One cannot converse long with dairy farmers without being asked for suggestions regarding the use of weathered hay during the coming winter. Few farmers have been so fortunate or so skilful as to secure the whole of their hay early and in really good condition, and many have a large proportion of unsatisfactory fodder to consume. It is possible, although not generally advisable, to induce cows to eat otherwise unpalatable hay by chaffing and mixing it with pulped roots, meals, or treacle water; and probably the use of about a quarter of an ounce of ground aniseed per cwt. of chaff would be advantageous in the absence of roots. The fundamental problem, however, is that of compensating the animal for the difference in nutritive value between good and bad hay. This difference in an ordinary daily allowance of 15 lb. of hay may require an increase

* For fuller particulars as to pickling seed wheat, see the Ministry's Leaflet, No. 92, 1925 Edition.

of about 3 lb. in the ration of concentrates; and this addition will cost about £3 per cow during the winter. The heaviest yielders, however, should receive a reduced quantity of the inferior hay, and if necessary a further allowance of corn; lower yielders may be required to utilize a greater proportion of hay.

Liver Fluke.—Past experience of wet summers warns the grassland flock master of the possibility of a severe outbreak of liver rot during the coming winter. The sheep losses after the wet season of 1879 are still remembered by the older generation of farmers; and recently in the Bangor area, where the agricultural advisory officers have this problem under special observation, the number of sheep affected has been found to vary in close relation with the rainfall of the preceding summer. The reason for this relationship lies in the fact that the fluke passes its early stages in the body of certain small water snails; and when these spread on to grass fields and multiply, as they do in wet summers, they distribute the parasites which, when consumed with herbage, ultimately become flukes in the liver, bile duct and gall bladder of sheep and cattle.

Both prevention and treatment of liver fluke are being investigated with successful results, the first being based on the eradication of the snail, without which the fluke cannot be reproduced. At this date, however, the remedial treatment of sheep that have grazed on suspected land is of more interest. Early recognition of the symptoms of the disease is essential, and if there is reason to suspect infestation, one of the suspected sheep should be killed, opened and thoroughly examined. If flukes are found in this, the whole flock should be treated by a veterinary surgeon.

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NOTES ON MANURES FOR NOVEMBER

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Autumn Manuring.—*Phosphates.*—At this time of year, interest centres chiefly round the use of phosphatic fertilizers. Two cases commonly arise on the arable land:—

(1) Autumn-sown corn crops, wheat, oats, beans and forage mixtures.

(2) Seed leys after the nurse crop has been harvested.

It will be recognized that the actual amount of phosphate needed by these crops will be determined chiefly by the nature

of the particular soil, the general response of which to phosphatic treatment is likely to have been observed in the course of cropping. The climate will also have some bearing on the matter, since, other things being equal, wet districts need more phosphate than dry ones. Finally, the amounts of dung or of phosphatic fertilizers used for the preceding crop will affect the case.

A common dressing for the autumn-sown crops would be about 2 cwt. of superphosphate per acre, or its equivalent of other phosphatic fertilizers, but the dressing would vary from nothing up to 4 cwt., according to the above considerations. It is desirable that the phosphate should be mixed with the surface soil of the seed bed before drilling rather than broadcast afterwards, as the roots of the seedling plants should have some phosphate in their immediate neighbourhood, and this is the more important when insoluble phosphates are used.

Similar dressings might go to the young seeds in their first autumn, but, in this case, the quantity of phosphate given to the cereal crop under which the seeds were sown would be the main guide. When it is thought that phosphates are required for young seeds, the earlier the dressing is given the better.

As far as the source of phosphate is concerned, autumn dressings tend to smooth out the differences in activity between the various types. Superphosphate, high-grade basic slag, and steamed bone flour may each be used with confidence, the relative prices being the main point of consideration. Finely ground North African phosphate has given good results in certain districts, especially on soils strongly in need of phosphatic treatment. Further experiments on this subject are needed in many areas. Another possibility of reducing costs would be to supply part of the phosphate in water-soluble form and the remainder as ground phosphate.

Potash.—Autumn dressing of potash salts in the arable will be less general. On the lighter soils, and where dung is scarce, such autumn corn as may be grown would probably benefit from a light dressing of muriate of potash, say ½ cwt. per acre, in addition to the phosphate. Especially would this be the case for leguminous crops, *e.g.*, beans and clover, which have been observed to respond well to potash even on medium soils.

Insoluble Phosphates.—Until recent years, the standard phosphatic manures for arable purposes were superphosphate and high-grade, 40 per cent., basic slag, each of these being readily available to plants after mixture with the soil. Lately,

owing to changes in the grade and composition of some of the basic slags, attention has been turned to the possibility of using the finely ground rock phosphates for agricultural purposes, especially as these forms provide phosphate at a relatively cheap price per unit. It was on grassland, however, that the possibilities of rock phosphates were most extensively tried at the outset; and the value of finely ground North African phosphate for pasture improvement has been brought out by many experiments, with the result that, in many places, it is used with confidence, for this purpose, as an alternative to basic slag or superphosphate. It appears to have made most headway in districts with good rainfall, although experiments are on record in which it has given quite good results in drier areas. The possibilities of rock phosphate for arable purposes have been less explored. An interesting report of his experiments on this subject, conducted in Northern Ireland over the period 1921–26, is given by Prof. Scott Robertson in a new journal.* On comparing the effects of superphosphate, high-grade basic slag, and Gafsa phosphate, under arable conditions, on a number of soils, all of which were more or less acid, it is shown that the nature of the crop makes a considerable difference to the relative performance of the manures. In the case of turnips, all the phosphates tried were about as effective as the water-soluble form, while in the case of potatoes superphosphate showed a marked superiority. All forms showed similar large residual effect in oats, taken after turnips treated with phosphate, and here basic slag was probably the best. Hay as the third crop without further phosphate did quite well in the control areas—plots which had been a complete failure in turnips three years before through lack of phosphate; and a slight, and approximately equal, residue for all forms was observable in the hay. It is concluded from the experiments that, in the district covered, Gafsa can replace superphosphate for turnips, but not for potatoes, and the Gafsa and high-grade slag can be regarded as alternatives. It was found that on the whole superphosphate did better than Gafsa phosphate on the peaty soils, and that in the very wet year 1924 the superphosphate again showed to advantage over the rock phosphate. It was noted in the field that water-soluble phosphate was more effective than Gafsa in helping the turnip plant in the earlier stages, and also caused the potatoes to start earlier and ripen quicker.

Journal of Ministry of Agriculture for Northern Ireland, Vol. I, 1927.

Farmers' Experiments.—A great many trials are conducted with fertilizers in various parts of the country and are the most direct way of ascertaining the manurial requirements of soils. The value of these trials increases when the results can be interpreted with due regard to the magnitude of the experimental error, thus estimating whether observed differences are actually due to treatments or are merely accidental. It must also be borne in mind that the results of a single experiment may not be confirmed under the conditions of the following seasons, a fact which make is desirable to repeat experiments over a series of years.

Moreover it is not permissible to apply the results of a trial carried out under one set of conditions to cases where the circumstances are different, though this often occurs on a single farm. The more the soil and climatic conditions in two districts approximate, the more likely is it that indications obtained by experiments in the one will be borne out in the other.

Such methods are complicated, demanding considerable work in the field, and are more within the scope of experimental institutions than of individual farmers. When experiments of this type cannot be undertaken, as would be the case on the ordinary farm, and tests are conducted with manures or varieties on large plots with no repetition, one has to be content with a much lower degree of precision, and nothing but very broad differences, which easily meet the eye, can be accepted with certainty. It appears, therefore, that experiments conducted by the farmer on his arable land are only useful as a general guide and will not serve to bring out small differences. Difficulties in applying manures and weighing produce also occur, to say nothing of uncertainty in interpreting the results. The chief advantage is that the soil in question is the actual one which concerns the farm. On grassland the case is somewhat different. The crop remains unchanged for a long period, differences due to treatment with fertilizers being, frequently, very striking and easily recognized by inspection. Such matters as the need of the permanent grass for phosphate, potash, and lime, and the effect of nitrogenous manures, can quite readily be decided by farmers themselves by direct trial and observation over a period of years.

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PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending October 5				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 5	11 5	14 6
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 2*	10 2*	10 2*	10 2*	9 10
Calcium cyanamide (N. 19%) ..	8 10‡	8 10‡	8 10‡	8 10†	8 11
Kainit (Pot. 14%)..	3 2	2 17	2 17	2 17	4 1
Potash salts (Pot. 30%)	4 17	..	..	4 14	3 2
„ (Pot. 20%)	3 12	3 2	3 7	3 6	3 4
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 13	9 8	3 6
Sulphate „ „ (Pot. 48-51½%)	11 10	10 5	10 16	11 6	4 5
Basic Slag (T.P. 32%)	3 8§	3 3§	3 3§	..	..
„ (T.P. 30%)	3 6§	3 1§	3 1§	2 15*e*	1 10
„ (T.P. 28%)	..	2 12§	2 13§	.	..
„ (T.P. 26%)	..	2 6§	2 7§	..	..
„ (T.P. 24%)	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10*d*	0 10
Fine grade‖	2 10	..	..	2 7*d*	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 4	3 0	1 9
„ (S.P. 33%) ..	..	..	3 2	..	..
„ (S.P. 30%) ..	2 15	2 15	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ½%, T.P. 60-65%)	5 17†	6 2†	6 5	5 17	..
Burnt Lump Lime	1 9	1 12*a*	1 16*b*	2 1§	..
Ground Lime	1 18	2 1*a*	2 6*b*	1 15§	..
„ Limestone	..	..	1 10*b*	..	..
„ Chalk	..	1 9	..	1 5§	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station.

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of towns mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull. *b* Delivered to Liverpool area.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.O.R. Northern rails; 3s. 6d. per ton extra on Southern rails.

NOTES ON FEEDING STUFFS FOR NOVEMBER

H. E. WOODMAN, PH.D., D.SC.,
School of Agriculture, Cambridge.

The Ensilage of Sugar Beet Tops.—It is of importance to continue to discuss the subject of sugar beet tops, already dealt with in some of its phases in recent issues of this JOURNAL. The beet crop is one of the few bright spots which can be discerned in the somewhat drab agricultural outlook of to-day, and therefore our thoughts turn hopefully in that direction. What the future may hold for the beet sugar industry in this country cannot at the moment be predicted with any confidence. It is certain, however, that the industry will only be able to flourish as an independent factor in national life when we have learnt to make the fullest possible use of all the manifold by-products which arise in connexion with the beet crop both in the field and in the factory. It is of the highest importance that the agriculturist should be in possession of all the information which patient investigation in field and laboratory has been able to accumulate in respect of the cultivation and utilization of the crop.

It has already been indicated that the most economical and satisfactory utilization of sugar beet tops consists in allowing stock to eat them directly off the land. Where large areas of sugar beet are grown, however, it may not be possible to secure consumption of the whole of the tops before decomposition of the material sets in. What is the farmer to do in such a case ?

Two courses are open to him. He may, on the one hand, plough the surplus tops into the land as manure. The question of the manurial value of sugar beet tops will be dealt with in a concluding article on this subject in the notes for next month. He may, on the other hand, decide to preserve a certain proportion of the tops for use in winter feeding.

The preservation of sugar beet tops can be effected in two ways, either by artificial drying (as practised on the Continent) or by ensilage. The drying down of such sappy material as beet tops is essentially a factory process and can hardly under any circumstances be contemplated by the farmer. He can only look forward to the time when the beet sugar factories may be in a position to regard this method of preservation as a commercial proposition. It follows, therefore, that the

farmer who wishes to preserve these residues must inquire into the possibility of achieving his purpose by a resort to ensilage.

The ensilage of sugar beet tops, however, is not unattended with difficulty. There is firstly the trouble and expense of carting the tops, especially on heavy land. There is the additional difficulty of filling the wet, heavy tops into a tower silo, a difficulty which would not wholly be removed if a convenient method of cutting up the tops were available. Moreover, at the season when the sugar beet crop is lifted, the silo is frequently full, and the contents are ready for being fed to stock. The results of our silage investigations at Cambridge have also shown that when a mass of wet material like beet tops is superimposed in the silo on a crop which has been ensiled at a suitable moisture content, then the losses of nutrient matter in the lower layers may be augmented very considerably.

It might be suggested that a way out of these difficulties would be to adopt the alternative method of ensiling the tops in a pit or clamp. The losses of nutrient matter in these processes would, however, be excessive, in consequence of the wetness of the crop, and the resulting silage would almost inevitably be of an objectionable "sour" quality. Further, the presence of small amounts of a nitrogenous substance called betaine in these beet residues might lead to the silage acquiring the obnoxious odour of trimethylamine, should partial spoiling occur. It need only be added that the smell of this substance is that of putrid fish. By no means is it asserted that the production of a good type of silage from beet tops is not possible by this method; it would, however, call for the exercise of considerable skill and careful management.

Why, however, when we think of ensilage, should we necessarily have visions of the tall and roomy towers which are usually erected for this purpose? For many years now we have employed at Cambridge, for experimental purposes, small, inexpensive, cylindrical wooden silos, measuring 6 ft. in height and 4 ft. in diameter. These small silos, which could be made portable if desired, are simply constructed of 1 in. boards, tongued and grooved and kept tightly pressed together by three circular iron hoops, which can be kept tightened by suitable screws. The wood is of plain deal, tarred externally for purposes of preservation. The floor of each silo simply consists of puddled gault clay. At the time of filling,

metal extensions 2 ft. high are fitted to the top of the silos. After completion of filling, the crop is covered with a layer of soil and the metal extensions are used as covers to protect the contents of the silos from the effects of the weather. Silage equal in quality in every respect to that made in a tall tower silo can be produced in these smaller containers, and it was in such diminutive silos that our experiments on the ensilage of sugar beet tops were carried out.

The following account summarizes our experiences in one typical experiment. The crop of sugar beet was topped on or about October 30, 1924. The tops were allowed to wilt in the field until November 14, during which time they were subjected to the adverse influences of variable weather conditions. For that reason the conditions for ensiling the tops were probably unfavourable to the best possible results being obtained. *The wilted tops were ensiled whole*, care being taken to ensure tight packing. The silo was opened on March 3, 1925. Considerable settlement of the crop had occurred during storage. A maximum thermometer, which had been buried in the material, recorded only a slight rise of temperature.

In spite of the somewhat unfavourable conditions of the trial, the resulting silage was of unexpectedly good quality. It possessed a pleasant, fragrant smell. It was cold and wet to the touch, sourish to the taste, and had retained the faded green colour of the crop as ensiled. There was an entire absence of the unpleasant pungent odour associated with butyric acid. The beet crowns appeared, to the eye, to have suffered very little change. Chemical investigation showed that the changes which had been suffered by the beet tops during storage were of the type usually associated with the production of good silage. The dry matter content of the material had risen from 17·5 to 19·3 per cent. during the period of preservation, mainly as a result of copious losses of juice. As would therefore be anticipated, the losses of nutrient matter were excessive, amounting to 28 per cent. of the total organic matter in the ensiled crop.

In another trial, a common Continental practice was followed in filling a small silo with alternate layers (each layer weighing about ½ cwt.) of wet sugar beet pulp and *whole*, wilted sugar beet tops. In spite of the fact that the tops were slightly rotted in parts at the time of filling, the silage, obtained when the silo was opened after a month's interval, was of very good quality and possessed the fragrant smell associated with silage from sugar beet tops alone. The pungent odour of

butyric acid was entirely absent. The silage was eaten eagerly by both heifers and sheep. It may be observed, further, that in no similar trial in the small silos had so little wastage by spoiling been noted, the silage being of good quality right up to the soil covering. The losses of nutrients during preservation were again considerable, 20 per cent. of the organic matter of the crop being lost as a result of fermentation and juice drainage.

Digestion trials with sheep carried out on this "pulp plus tops" silage yielded eminently satisfactory results, no less than 81 per cent. of the organic matter being digested and utilized by the animals. The high digestion coefficients of the carbohydrate (85 per cent.) and of the fibre (82 per cent.) were especially noteworthy. It was found that every 100 lb. of the dry matter of the silage contained as much as 65 lb. of starch equivalent. Obviously, the production in small, inexpensive silos of such palatable and highly nutritious silage from mixtures of beet tops and wet sugar beet pulp offers distinctly attractive possibilities on farms *situated in the vicinity of beet sugar factories*. The cylindrical silos referred to above, 6 ft. high, with a diameter of 4 ft., might be expected to contain when opened for use, 10 cwt. or more of good, utilizable silage.

It can scarcely be claimed, however, that the use of such small containers affords a satisfactory solution to the difficulties of the farmer who wishes to ensile large areas of beet tops. In such a case, it will be necessary to devise means whereby the tops can be filled into a large tower silo, and the writer would be glad to hear from any farmer who has experience of this operation. Under present conditions, however, where even large areas of sugar beet are grown, it is probable that the farmer will only ensile that fraction of tops which he decides cannot be eaten directly before putrefaction begins; and it is doubtful whether such fractions will be even of such magnitude as to fill a silo of, say, 50 ton capacity.

* * * * * *

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	10 9
Maize	81	6·8	8 3
Decorticated ground nut cake	73	41·0	12 15
„ cotton cake	71	34·0	10 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·42 shillings, and per unit protein equivalent, 1·89 shillings.

In accordance with the recommendation of the Departmental Committee on Rationing of Dairy Cows,* the "food values" given in the following table may be taken as applicable to the ensuing four months, December to March, inclusive, for the purposes of advisory schemes on the rationing of dairy cows.

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
Roots—	Per cent.	Per cent.	£ s.
Kohl Rabi	8	0·5	1 0
Mangolds	7	0·4	0 18
Potatoes	18	0·6	2 5
Swedes	7	0·7	0 18
Turnips	5	0·4	0 13
Green foods—			
Cabbage, drumhead	7	0·9	0 19
„ open-leaved	9	1·5	1 5
Kale, marrow stem	9	1·3	1 4
Silage, vetch and oats	13	1·6	1 14
Hay—			
Clover hay	32	7·0	4 11
Lucerne hay	24	7·9	3 13
Meadow hay, poor	19	2·9	2 11
„ „ medium	31	4·6	4 4
„ „ very good ..	40	7·8	5 11
Seeds hay	24	4·9	3 7
Straws—			
Barley straw	19	0·7	2 7
Bean straw	19	1·7	2 9
Oat straw	17	0·9	2 3
Wheat straw	11	0·1	1 7
Grains and seeds—			
Barley	71	6·2	9 3
Beans	66	20·0	9 17
Oats	60	7·6	8 0
Peas	69	18·0	10 1
Wheat	72	9·6	9 12

*Report obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	10 17	0 13	10 4	72	2 10	1·52	9·6
Barley, British feeding	—	—	11 5	0 10	10 15	71	3 0	1·61	6·2
„ Canadian No. 3 Western	40 6	400	11 7	0 10	10 17	71	3 1	1·65	6·2
„ American	36 6	„	10 5†	0 10	9 15	71	2 9	1·47	6·2
„ Danubian	38 0	„	10 13	0 10	10 3	71	2 10	1·52	6·2
„ Karachi	38 0	„	10 12*	0 10	10 2	71	2 10	1·52	6·2
„ Persian	37 0	„	10 7	0 10	9 17	71	2 9	1·47	6·2
Oats, English, white	—	—	9 13	0 11	9 2	60	3 0	1·61	7·6
„ „ black and grey	—	—	9 15	0 11	9 4	60	3 1	1·65	7·6
„ Irish, black	—	—	9 8	0 11	8 17	60	2 11	1·56	7·6
„ Canadian feed	29 6	320	10 7*	0 11	9 16	60	3 3	1·74	7·6
„ New Zealand	33 3	„	11 13*	0 11	11 2	60	3 8	1·96	7·6
„ Argentine	28 9	„	10 2	0 11	9 11	60	3 2	1·70	7·6
Maize, Argentine	35 0	480	8 3	0 10	7 13	81	1 11	1·03	6·8
Peas, Indian, white	—	—	12 0*	1 2	10 18	69	3 2	1·70	18
Dari, Egyptian	—	—	10 10	0 12	9 18	74	2 8	1·43	7·2
Rye, homegrown	—	—	10 5	0 13	9 12	72	2 8	1·43	9·1
Millers' offals—									
Bran, British	—	—	8 0	1 3	6 17	42	3 3	1·74	10
„ broad	—	—	9 0	1 3	7 17	42	3 9	2·01	10
Middlings, fine, imported	—	—	10 2	0 18	9 4	69	2 8	1·43	12
„ coarse, British	—	—	8 15	0 18	7 17	58	2 8	1·43	11
Pollards, imported	—	—	8 0	1 3	6 17	60	2 3	1·20	11
Meal, barley	—	—	12 10	0 10	12 0	71	3 5	1·83	6·2
„ maize	—	—	9 5	0 10	8 15	81	2 2	1·16	6·8
„ „ S. African	—	—	8 15	0 10	8 5	81	2 0	1·07	6·8
„ „ germ	—	—	9 0	0 16	8 4	85	1 11	1·03	10
„ „ gluten feed	—	—	9 0	1 1	7 19	76	2 1	1·12	19
„ locust bean	—	—	8 17	0 8	8 9	71	2 5	1·29	3·6
„ bean	—	—	12 0	1 6	10 14	66	3 3	1·74	20
„ fish	—	—	21 0	3 10	17 10	53	6 7	3·53	48
Maize, cooked flaked	—	—	10 12	0 10	10 2	85	2 5	1·29	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 10	1 10	11 0	74	3 0	1·61	25
„ „ „ 10% „	—	—	12 0	1 10	10 10	74	2 10	1·52	25
„ „ „ 9% „	—	—	11 15	1 10	10 5	74	2 9	1·47	25
Soya bean „ „ 6% „	—	—	11 10	2 3	9 7	69	2 9	1·47	36
Cottonseed cake „ 5½% „	—	—	7 7	1 8	5 19	42	2 10	1·52	17
„ „ Egyptian, 5½% „	—	—	7 2	1 8	5 14	42	2 9	1·47	17
Decorticated cottonseed meal, 7% oil	—	—	11 15†	2 3	9 12	74	2 7	1·38	35
Coconut cake, 6% oil	—	—	10 0	1 5	8 15	79	2 3	1·20	16
Ground-nut cake, 7% oil	—	—	10 5†	1 8	8 17	57	3 1	1·65	27
Decorticated ground-nut cake, 7% oil	—	—	12 15†	2 3	10 12	73	2 11	1·56	41
Palm kernel cake, 6% oil	—	—	9 7	0 18	8 9	75	2 3	1·20	17
„ „ „ meal, 6% oil	—	—	9 5*	0 18	8 7	75	2 3	1·20	17
„ „ meal 2% „	—	—	8 7	0 19	7 8	71	2 1	1·12	17
Feeding treacle	—	—	6 10	0 8	6 2	51	2 5	1·29	2·7
Brewers' grains, Dried ale	—	—	7 10	0 19	6 11	49	2 8	1·43	13
„ „ „ porter	—	—	7 0	0 19	6 1	49	2 6	1·34	13
„ „ Wet ale	—	—	0 16	0 7	0 9	15	0 7	0·31	4·8
„ „ „ porter	—	—	0 12	0 7	0 5	15	0 4	0·19	4·8
Malt culms	—	—	7 10‖	1 8	6 2	43	2 10	1·52	16

* At Hull. † At Bristol. ‖ At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of September and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £9 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding-stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 7d.; P_2O_5, 3s. 10d.; K_2O, 3s. 0d.

MISCELLANEOUS NOTES

The Sussex Baby Beef Club

THE members of this club, which affords a striking example of the value of the Young Farmers' Club Movement in connexion with agricultural education, are drawn from a wide area in the county, some of the boys and girls travelling as much as 16 to 20 miles to attend the club meetings. This keenness and the high standard of work maintained are due, in great measure, to the untiring efforts of the President, Mr. T. Bannister, by whom the club was promoted at Haywards Heath in 1922, and of Mr. Noakes, the Club Leader; and their enthusiasm has also evoked the interest of the members' parents, who follow the activities of the club with close attention and not a little pride.

During the past three seasons, the members have put up a very creditable record, providing, from their number, the County Champion Team for Dairy Cattle Judging in 1925 and 1926, although the objects of the club centre mainly in beef cattle. The club also provided two of the three members of the English team selected, in open competition at the Dairy Show in 1925, to compete against the National American Champion team for the International Championship in Dairy Cattle Judging. This English team, comprising two Sussex boys from the club and one Sussex girl (from the Heathfield Friesian Calf Club) thus won the Gold Challenge Cup for the first time in the history of the English Young Farmers' Club Movement. The club further had the honour of supplying all the members of the English team which successfully defended the cup against the Americans last summer.

Very careful records are kept of the work done by the members; and the calves in their possession are regularly weighed each month by the Club Leader, either on an ordinary weighbridge or on sack scales specially adapted to meet local conditions. From these records detailed statistical information is prepared, showing the age and type of calves, the quantities and varieties of food used, with particulars of costs and profits. The results provide much interesting material which might form the basis of useful lectures to members of similar clubs. As an example of these records, one may take the case of a heifer calf, born in April, 1925, which, at the request of some of the South African farmers visiting England in that year, was, as an experiment, fed on a ration which included crushed maize. On September 1, 1925, it weighed

256 lb., and had cost, with insurance, £11 3s. 0d. During the ensuing year it consumed 1,175 lb. of roots, 1,045 lb. of hay, 2,337 lb. of green food, 1,603 lb. of crushed oats, 60 lb. of linseed cake and 964 lb. of crushed maize, the total cost of which amounted to £14 15s. 3d. On August 26, 1926, on which date it was sold, it weighed 886 lb., having gained 630 lb. during the year, the food cost working out at 5·62d. per lb. gain in live weight. The price realized was £27 6s. 0d.

* * * * * *

DISPLAYS of Empire Produce have recently been staged under the ægis of the Empire Marketing Board at the following exhibitions :—

Displays of Home Produce

Exhibition	Place	Date
International Grocers' Exhibition.	Agricultural Hall	Sept. 17–23.
Commercial and Industries Exhibition.	Liverpool.	Sept. 23–Oct. 1.
Norwich Grocers' Exhibition.	Norwich	Oct. 5–15.

These exhibitions have been well attended, over 200,000 people passing through the hall at Liverpool, and the Empire Marketing Board displays have been widely appreciated.

In pursuance of the Board's declared policy to encourage the purchase of home produce where available, the Ministry was requested to assume responsibility for a Great Britain stand in each case. An attractive display of home-produced foodstuffs was accordingly arranged through the good offices of the National Farmers' Union, Food Manufacturers' Federation, National Food Canning Council, National Association of Cider Makers, British Glasshouse Produce Marketing Association, Western Curers' Association, Cheshire Cheese Federation, and the English Cheddar Cheese Makers' Federation.

Great interest was show in the variety and quality of home products ; and, in particular, dessert apples, glasshouse produce and crustless cheese evoked much favourable comment. Photographs of the stand at the International Grocers' Exhibition are reproduced opposite.

At the Imperial Fruit Show, to be held at Belle Vue Gardens, Manchester, from October 28 to November 5, the Empire Marketing Board is taking the whole of one pavilion, and arrangements are being made for a striking display of home-grown fruits, potatoes, fruit products and glasshouse produce.

Empire Marketing Board's Advertising Campaign.—The claims of home produce are being kept well to the front in the

Display of Home Produce at the International Grocers' Exhibition, London.
Left side of the Stand.

To face page 768.

Display of Home Produce at the International Grocers' Exhibition, London.
Right side of the Stand.

Empire Marketing Board's Advertising Campaign: the "Flag" poster.

WHAT THE EMPIRE MARKETING BOARD ASKS YOU TO DO

THE BOARD'S appeal to you is simple. It invites you, in your daily shopping, to demand first the produce of your own country. The fields and farms of home are none the less a part of Empire because they are near and familiar; and "Empire buying begins at home."

The Board invites you next to ask for the produce of the Empire beyond the seas. In so far as you can find Empire produce, whether it be from home or overseas, that is satisfactory in price and quality, the E.M.B. asks you to give it your first choice.

* * * *

TO-DAY'S PICK
OF THE EMPIRE BASKET

◆

Home

Apples *Pears*

Plums

BUY EMPIRE PRODUCE
from Home and
Overseas

ISSUED BY THE EMPIRE MARKETING BOARD

The Empire Marketing Board's Advertising Campaign:
A specimen Press advertisement.

Press advertisements and posters now being issued by the Board. A specimen advertisement and poster released recently are reproduced here.

* * * * * *

Rothamsted Winter Lectures

ARRANGEMENTS have been made, as in previous years, to enable members of the Rothamsted Experimental Station Staff, during the coming winter, to give a few lectures upon the Station experiments to Chambers of Agriculture and Horticulture, Farmers' Clubs, Farm Workers' Associations, Agricultural Societies, etc. No fee will be charged for the lecturers' services, but any association desiring to engage them will be expected to defray travelling and hotel expenses, also to make any necessary arrangements for holding the lectures. As far as possible, the wishes of associations in regard to dates and subjects will be met, provided sufficiently long notice is given. It will not be practicable to deal with more than one subject in a single lecture. Communications regarding lectures, indicating subject or subjects and suggested date or dates, should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden, Herts. The list of subjects and lecturers is as follows :—

LECTURES BY MR. H. V. GARNER, M.A., B.Sc., AND OTHER MEMBERS OF THE FARM AND EXPERIMENTAL FIELDS STAFF

(1) Artificial Fertilizers and their Use in Practice.
(2) The Management of Farmyard Manure.
(3) The Use of Lime in Agriculture.
(4) Recent Work on the Manuring of Potatoes and Sugar Beet.
(5) Some Points in Manuring a Rotation of Crops.
(6) Manuring as a Factor in Grassland Improvement.
(7) The Rothamsted Field Experiments, 1843-1926.
(8) Recent Additions to the List of Artificial Manures.
(9) The Growing of Sugar Beet.
(10) The Growing of Lucerne.
(11) Fallow and Fodder Crops.
(12) Malting Barley.

OTHER LECTURES

(1) *Soil Micro-Organisms* (*Bacteria, Protozoa, etc.*)

Lucerne Inoculation. Life in the Soil. Biological Aspects of Partial Sterilization.	Mr. H. G. Thornton, B.A. Mr. D. W. Cutler, M.A.

(2) *Agricultural Botany*

Weeds of Arable and Grass Land.	Dr. Winifred E. Brenchley, F.L.S.

(3) *Agricultural Chemistry*	
Liming and Chalking of Soils. Green Manuring; its place in British Agriculture. Basic Slag and Mineral Phosphates: their value in Agriculture.	Dr. E. M. Crowther, F.I.C. Mr. H. J. G. Hines, B.Sc.
(4) *Soil Physics*	
The Principles of Soil Cultivation. The Place of the Tractor in Soil Cultivation. Soil Moisture and Temperature, and their control.	Dr. B. A. Keen, F. Inst. P.
(5) *Insecticides and Fungicides*	Mr. F. Tattersfield, B.Sc. Mr. C. T. Gimingham, F.I.C.
(6) *Entomology*	
Insect Pests.	Dr. A. D. Imms, M.A.
Horticultural, Market Garden and Orchard Pests.	Dr. J. Davidson, F.L.S.
Bee Keeping.	Mr. D. M. T. Morland, M.A.
(7) *Mycology*	
Potato Disease (Wart, Virus, etc.) Plant Diseases: their causes and control. Soil Fungi and Plant Growth. Fungus Pests of Crops.	Dr. W. B. Brierley, F.L.S.

* * * * * *

Varieties of Potato Immune from Wart Disease

THE following further additions have been made to the official list of approved immune varieties (see this JOURNAL, October, 1927, page 679) as a result of the introduction into commerce of "Sunrise" and "Arran Banner." These varieties successfully passed the test in the Wart Disease Immunity Trials carried out at Ormskirk in 1925 and 1926, respectively. Descriptions of the varieties are appended:—

Second-Early Variety

"*Sunrise*"

Sprout.—Pink.

Tuber.—Kidney; skin white mottled pink; flesh pale lemon; eyes shallow.

Haulm and Foliage.—Fairly vigorous, spreading; leaflets grey-green, long, narrow, corrugated, glossy, harsh appearance; secondary leaflets small, few; stem faint coloration at base only; wings straight.

Flowers.—Pale heliotrope.

Late or Maincrop Variety

" *Arran Banner* "

Sprout.—Pink.

Tuber.—Round, slightly flattish; skin white; flesh white; eyes medium, deeper at the rose end.

Haulm and Foliage.—Tall, open, upright; leaflets medium grey-green, soft, wrinkled and dull appearance, medium size, roundish; leaf open; stems green with slight bronzing in the axils; wings straight; secondary leaflets large.

Flowers.—None observed; flower buds pink.

* * * * * *

Onion Storage in North Holland

IN an article in the *Tuinderij*, an account is given of the methods of harvesting and storing onions practised in North Holland. Horticultural holdings in that region are usually of limited extent, and the growers are able to give the crop special attention which probably would be too costly if larger quantities were handled.

Immediately on lifting the ripened crop, the small onions are separated out and are usually sold for pickling. Only the larger onions are stored, and these are set up in piles in the open field. The piles are made with the aid of a " piler," which consists of a circular iron band supported on four legs.

The band, which has a certain amount of flexibility, is perforated at intervals with holes, into which a knob at one end will fit, being kept in place by a slip ring passed over the point of junction. By this means, the diameter of the circle can be varied, within limits, as desired, very much as a body belt can be drawn in or relaxed. A layer of straw having been spread upon the ground, the " piler " (Fig. 1) is stood upright upon it. A walling of reeds, set vertically, is then placed round the " piler," being secured in position against it by encircling two bands of strong iron wire at the top and bottom.

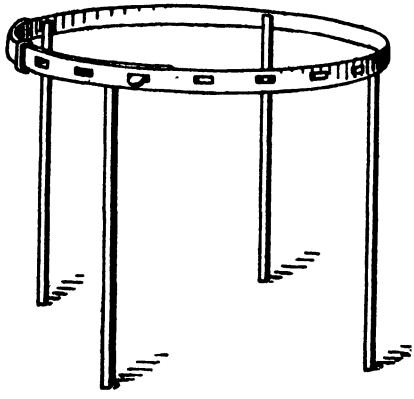

FIG. 1.—The onion " piler."

The onions are then filled in, care being taken to secure an even pack, and as the compartment is gradually filled, the " piler " is raised and a third wire band is fixed to keep the reeds in position higher up, onions being put in on the top of those already deposited. Once again, the " piler " is raised for fixing a fourth wire band and bringing in more onions, care being taken that the wires are placed at equal distances. The " piler " is then withdrawn. Before finishing a pile, the onions have to subside, and the pile is, accordingly, left for a few days, being covered over temporarily with old sacks to exclude rain. After the final filling up, a conical and projecting cap of straw thatch is then put on the top and securely fastened down to the wire bands.

It will be realized that the stability of a pile centres mainly in the weight of the onions, any tendency to side-slip being checked by the walling of reeds held in place by the outer wire bands ; but it is necessary to add that satisfactory piling of the onions calls for a regular method in packing and a certain amount of practice.

Piles thus constructed are left undisturbed until the contents are wanted, receiving, meanwhile, the beneficial effects of sun and wind in the open field. It is not advisable to construct the piles where they would be shut out from these influences by trees or buildings. No attention is required by the piles beyond an occasional inspection, especially after storms, to see that the caps have not been damaged or dislodged. This method of storing does not give protection against frost, certainly not against severe frost, but the onions can sustain a sharp night frost without danger. Should they become frozen, they must not, in any circumstances, be handled until the frost has thawed out.

The " pilers " are 70 centimetres high (approximately 2 ft. 3 in.) and are usually set to a diameter of 90 centimetres (approximately 3 ft.), these being the normal dimensions of a pile, the contents of which average 600 kilograms (approximately 11·8 cwt.). By continuing to raise the " piler " and construct the reed walls with encircling wire bands, as previously described, the piles are often built up to a height of 1·6 metres (approximately 5 ft. 3 in.) as seen in the illustration (Fig. 2). In the case of the more slender piles, additional stability may be given by attaching vertical and horizontal stakes as stays against wind pressure.

Many North Holland growers grade their onions before sale into three classes, and higher prices are said to be realized for graded samples than for ungraded lots.

To face page 772.

FIG. 2.—Onion Storage in North Holland: Examples of piles formed with the "piler."

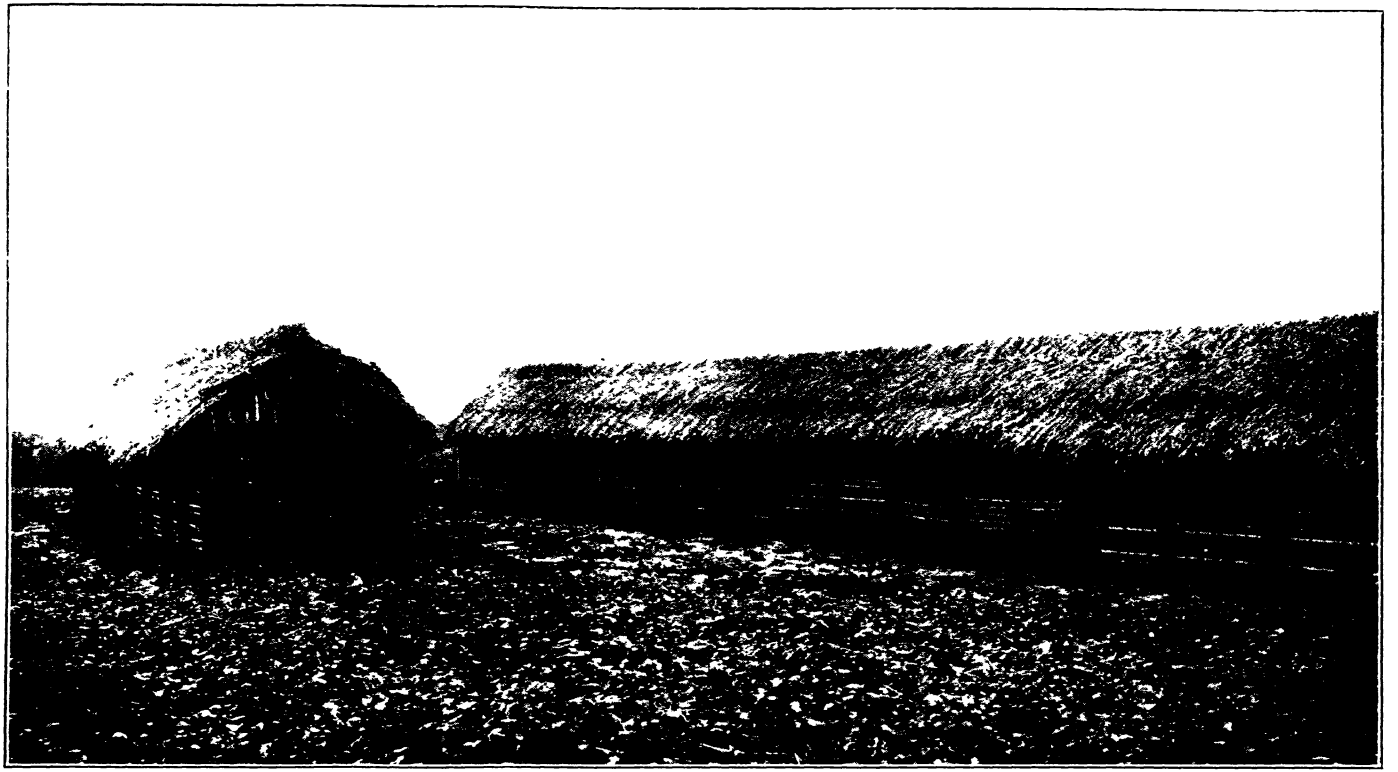

FIG. 3.—Examples of the Clamps used for storing Onions in the South Holland Islands and in Zeeland.

In the South Holland Islands and in Zeeland, the onions are stored in clamps of more elaborate construction, having strong uprights supporting open batten walls and thatched roofs. Examples of these are shown in Fig. 3.

Acknowledgments are due to Mr. B. Gerritzen, Horticultural Adviser to the Netherland Legation in London, and to the Editor of *Tuinderij* for assistance in preparing this note and for the loan of illustrations.

* * * * * *

The Agricultural Index Number

THE prices of agricultural produce as a whole have not varied considerably from those ruling in August, alterations as a rule having followed the usual seasonal fluctuations, and the general index figure is only one point higher on the month at 43 per cent. above the base years 1911-13. The index figure in September, 1926, was 55 per cent. above pre-war as compared with 49 per cent. in the previous month, but this increase was abnormal and due to the fact that whereas the contract price of milk in September is as a rule the same as in August, the price in September, 1926, was 4d. per gallon higher.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	42
September	59	52	61	55	55	43
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	46	—

There was the customary decline in wheat prices, the average falling from 12s. 6d. per cwt. in August to 11s. 1d. for the month under review, with a fall of 8 points in the index figure to 48 per cent. above 1911-13. In the corresponding period of 1926 wheat fell from 13s. 6d. to 11s. 3d. per cwt., and the index figure declined by 19 points to 50 per cent. above pre-war. Barley rose by 1s. 1d. per cwt. this September to an average of 13s. 6d. as compared with a rise

of 1s. to 12s. 6d. in September, 1926, the index figures declining 2 points in each period to 62 and 50 per cent. respectively above the pre-war level. A fall of 11d. per cwt. was recorded for oats in September to an average of 9s. 1d. per cwt., but this marks an increase of 8d. per cwt. on the price ruling a year ago, and oats are now 35 per cent. above pre-war as compared with 25 per cent. in September, 1926.

Live Stock.—With the plentiful supply of fat cattle on offer during September and the continuance of a slow demand, average prices were lower, second quality cattle being nearly 2s. per live cwt. cheaper than in August, and the index figure was 4 points lower at 30 per cent. above the base years. Fat sheep, however, remained unaltered in price and the index figure stood at 45 per cent. above pre-war as in the two preceding months. The price of bacon pigs declined slightly, while porkers failed to show much improvement on August values, and a decline of 2 points is recorded in the index figures to 34 and 41 per cent. above pre-war respectively. A year ago baconers were 79 per cent. and porkers 81 per cent. above the level of 1911-13.

The usual seasonal demand for dairy cattle occurred during September, and prices advanced about 20s. per head, the index number rising from 25 per cent. to 28 per cent. above the base years. A year ago prices advanced by about 15s. per head and the index figure rose 2 points to 39 per cent. dearer than pre-war. Store cattle, sheep and pigs, however, made lower prices than in August, and the index numbers for cattle and pigs fell by 2 and 6 points respectively to 24 and 64 per cent. above the level of 1911-13, while the index figure for sheep rose 1 point owing to a relatively greater fall in the base price in September, 1911-13.

Dairy and Poultry Produce.—During September butter and eggs continued their customary advance in price, the former being about 1d. per lb. and the latter 3d. per dozen dearer than in August, and the respective index figures advanced by 3 and 10 points to 41 and 54 per cent. above pre-war. Cheese prices also were higher during September and the index figure moved upwards from 57 to 59 per cent. above the base years. In September, 1926, butter was 56 per cent. and eggs were 52 per cent. dearer than in 1911-13, while cheese was only 34 per cent. dearer. Poultry was a little cheaper on the month at 37 per cent. above the prices ruling in the base years and cheaper also than a year ago, when the index figure stood at 46 per cent. above the pre-war level. Milk prices in most

districts in September were the same as in August, but higher prices ruled in the Manchester area, and the index number shows a rise from 55 per cent. to 65 per cent. above the pre-war level. At the corresponding period last year the September price for most areas, as fixed under the agreement negotiated by the Permanent Joint Milk Committee representing producers and distributors, was 4d. per gallon more than for August.

Other Commodities.—Potatoes averaged 46 per cent. above pre-war during September as compared with 40 per cent. a year ago. The prices of hay advanced a little on account of the difficulty in securing supplies this season, and at 18 per cent. above 1911-13 the index number was 2 points higher on the month and 9 points higher than in September, 1926. Apples in September were about 30 per cent. and pears about 15 per cent. above pre-war prices, but the increase in the case of plums was about 150 per cent. A year ago plums sold at almost pre-war prices. Vegetables commanded very similar prices to those ruling in August and averaged about 40 per cent. above 1911-13. Wool remained firm at 43 per cent. above pre-war.

Index numbers of different commodities during recent months and in September, 1925 and 1926, are shown below:—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	Sept.	Sept.	June	July	Aug.	Sept.
Wheat	53	50	60	56	56	48
Barley	69	50	54	57	64	62
Oats	43	25	33	33	43	35
Fat cattle	53	39	25	30	34	30
Fat sheep	69	52	48	45	45	45
Bacon pigs	66	79	54	43	36	34
Pork pigs	65	81	60	49	43	41
Dairy cows	46	39	21	25	25	28
Store cattle	37	28	21	26	26	24
Store sheep	90	63	53	55	48	49
Store pigs	75	142	90	80	70	64
Eggs	75	52	30	31	44	54
Poultry	58	46	53	52	43	37
Milk	63	100	53	55	55	65
Butter	70	56	41	42	38	41
Cheese	77	34	54	58	57	59
Potatoes	53	40	61	61	30	46
Hay	4	9	3	6	16	18
Wool	40	31	33	40	42	43

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on September 20 and 29, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions :—

Berkshire.—An Order to come into operation on October 12, continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until further notice. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours, with overtime at 8½d. per hour, and in the case of female workers of 19 years of age and over, 5d. per hour for all time worked.

Gloucestershire.—An Order to come into operation on October 9, continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 6, 1928. The minimum rates in question are, in the case of male workers of 21 years of age and over, head carters 34s. 6d. per week of 58 hours in summer and 36s. per week of 60 hours in winter; head shepherds or head stockmen, 36s. per week of 60 hours; under-carters 32s. 6d. per week of 54 hours in summer and 34s. 6d. per week of 57 hours in winter; under-shepherds or under-stockmen 34s. 6d. per week of 57 hours; and other classes of male workers 30s. per week of 50 hours in summer and 48 hours in winter. Overtime is payable to all male workers at the rate of 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers the minimum rate is 5d. per hour for all time worked, irrespective of age.

Hampshire and Isle of Wight.—An Order to come into operation on October 12 continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until varied by the Committee. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of 51 hours in summer and 48 hours in winter, with overtime at 8d. per hour, except in connexion with duties performed by carters, cowmen, shepherds or milkers in connexion with the care of stock, when the overtime rate is 7½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Lincolnshire (Holland).—An Order to come into operation on October 30 continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 27, 1928. The minimum rate in question in the case of male workers of 21 years of age and over is 35s. per week of 50 hours in summer and 48 hours in winter, with, in addition, in the case of cattlemen and shepherds 6s. per week, and in the case of horsemen 10s. per week to cover employment in excess of those hours on employment other than overtime employment. In the case of shepherds additional payments are to be made in respect of the lambing season. The overtime rate of wages for all classes of male workers of 21 years of age and over is 9d. per hour except on Saturdays, when it is 10½d. per hour, and on Sundays, when it is 1s. 1½d. per hour. In the case of female workers of 15 years of age and over the minimum rate is 6d. per hour for all time worked.

Somersetshire.—An Order to come into operation on October 1 fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers, to continue in

operation until September 30, 1928. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 52 hours in summer and 50 hours in winter, with overtime at 9d. per hour except in respect of employment on the hay and corn harvests, when the rate is 10d. per hour. In the case of female workers of 21 years of age and over the minimum rate is 6d. per hour for all time worked.

Wiltshire.—An Order to come into operation on October 12 continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours throughout the year, with overtime at 8d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Pembrokeshire and Cardiganshire.—An Order to come into operation on October 1 continuing the existing minimum and overtime rates of wages for male and female workers until September 30, 1928. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 50 hours in winter and 54 hours in summer, with overtime at 8½d. per hour on weekdays, 9½d. per hour for the first three hours of employment on Sundays and 11d. per hour for subsequent hours. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a day of eight hours, with overtime at 6d. per hour on weekdays, 6½d. per hour for the first three hours of employment on Sundays and 7½d. per hour for subsequent hours.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending October 15, legal proceedings were instituted against seven employers for failure to pay the minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines	Costs	Arrears of wages	No. of workers concerned
		£ s. d.	£ s. d.	£ s. d.	
Kesteven ..	Lincoln ..	1 0 0	3 0 0	22 0 0	2
Hereford ..	Ross ..	6 4 0	—	22 10 3	1
,, ..	Wigmore ..	4 0 0	5 18 0	52 0 0	2
Pembroke ..	Mathry ..	2 0 0	—	31 3 3	2
Derby ..	Bakewell ..	2 0 0	0 2 0	10 10 0	1
Cheshire ..	Stockport ..	*	0 8 0	9 12 0	1
Suffolk ..	Bungay ..	*	3 3 0	7 0 0	2
		£15 4 0	£12 11 0	£154 15 6	11

* Dismissed under the Probation of Offenders Act.

* * * * * *

Foot-and-Mouth Disease.—Ten outbreaks of foot-and-mouth disease have been confirmed since the report in last month's (October) issue of the JOURNAL, including a further outbreak in the Glamorgan area already referred to.

A fresh centre of disease was discovered on October 5 at Allerford, Selworthy, Somerset, and, since that date, seven other cases of disease have been confirmed in that neighbourhood. A fresh centre was also

discovered on October 5, at Enfield, Middlesex, but no further case has occurred in that area.

Forty-two outbreaks in all have been confirmed since January 1 last, involving 12 counties and the slaughter of 1,472 cattle, 1,560 sheep, 496 pigs and 2 goats.

* * * * * *

United Dairies Scholarships.—The third annual award of scholarships from the United Dairies Scholarship Fund has just been made. The scholarships are open to the sons and daughters of farmers and smallholders in Somerset, Cornwall, Devon, and Dorset, and are tenable at Reading University, the Somerset Farm Institute, Cannington, Bridgwater, and the Seale-Hayne Agricultural College, Newton Abbot, Devon. The successful candidates for this year are as follows :—

Two Years' Course at Reading University : R. J. Brine, R. Coleman, A. B. James, Miss M. E. Vowles.

Four Terms at Reading University : W. J. Badcock.

One Year's Course at the Somerset Farm Institute, Cannington : Miss M. Osborn.

One Year's Course at Seale-Hayne Agricultural College : J. W. T. Derges.

The fund, amounting to £30,000, which was created in 1924 by United Dairies, Ltd., for the purpose of promoting and encouraging practical and scientific education in dairying and dairy farming, also provides for one or more Travelling and Research Scholarships to enable advanced students to study these subjects at home or abroad. The terms and conditions of both ordinary and research scholarships for next year will be issued in the spring.

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National Diploma in Dairying.—The 32nd Annual Examination for the National Diploma in Dairying was held by the National Agricultural Examination Board at the University and British Dairy Institute, Reading, for English students, from September 2 to 10, 1927, and at the Dairy School, Kilmarnock, for Scottish students, from September 16 to 24, 1927. One hundred and twenty-three candidates presented themselves (76 at Reading and 47 at Kilmarnock), and 78 candidates (51 in England and 27 in Scotland) gained the Diploma. No candidate this year reached "Honours" standard. Following are the names of the successful candidates :—

English Centre.—Irene D. Beston, Phœbe F. Bond, G. S. Briggs, Dorothy A. Brunning, Ellen G. Butler, A. C. Castle, Edna M. Crossley, Gertrude M. Davies, William Evans, Mary L. Evelyn, Norah M. Fisher, Leslie F. Gregory, Hilda M. Hatchwell, Herbert Hodgson, Owena Jenkins, Muriel M. Johnston, Margaret M. Jones, W. A. Jones, Mildred P. Knowles, Doris S. Lindsay, Frances M. McDougall, Phyllis Madders, A. J. Marval, E. G. Owen, Dorothy A. Peake, Elizabeth G. Pritchard, Sarah D. J. Probert, J. B. B. Robertshaw, R. N. Sadler, Marjorie S. Sellers, J. N. Sharrock, K. Singh, M. H. Sumners, G. E. Taylor, Eleanor M. Thomas, Sylvia L. Udell, Margaret A. V. Griffiths, W. F. Heathfield, J. C. Mauger, Phyllis H. S. Read, Rose Ward, Kate Cragg, Winifred Davies, Sarah E. Gillson, Margaret F. Griffiths, Kathleen R. C. Hodgson, Millicent A. Hunt, Ruth M. Saxelby, H. C. Smith, W. A. G. Turbutt, Kathleen L. Wigglesworth.

Scottish Centre.—W. R. Alexander, N. S. Ayyangar, S. A. Child, Florence M. Clouston, Mary Cowell, George Dunlop, John Glen, Catherine H. M. Grant, Eric Knowles, Mary McArthur, Mary M. MacCaskill, Catherine McColl, Maggie MacDougall, Alice M. McMillan,

Christina Matheson, Ishobel McL. Millar, Clifford Pringle, Nance M. Reid, Thomas Robinson, David Strathie, J. H. Ward, Ruth H. Taylor, Molly A. Thomson, H. E. Wells, Agnes White, Mary R. Wilson, Norah S. Milne.

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Leaflets Issued by the Ministry.—Since the date of the list given in the May (1927) number of this JOURNAL, p. 185, the following leaflets have been issued :—

ADDENDUM to Leaflet No. 394 (Phosphatic Fertilizers), *Mineral Phosphates.*

New :—

No. 183. Cultivation of Raspberries.
No. 181. The Culture of Green Peas and Beans.
No. 196. Small Holdings, Cottage Holdings and Allotments.
No. 191. Asparagus Cultivation.
No. 209. Practical Soil Sterilization by Heat for Glasshouse Crops.

Rewritten :—

No. 352. Control of Pests in Fruit Trees.
No. 177. Precautions against Accidents caused by Farm Machinery.
No. 293. Soil Analysis.
No. 98. Grading and Packing of Apples.

Revised :—

No. 26. Farmers and the Income Tax.
No. 368. The Cultivation of Flax for Fibre.
No. 180. Dodder.
No. 244. The Destruction of Rats.
No. 400. List of Publications.

Amended :—

No. 265. Rabbit Keeping.
No. 193. Dry Rot of Potatoes.

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NOTICES OF BOOKS

The Economics of Small Holdings. By Edgar Thomas, with Preface by C. S. Orwin. (Cambridge University Press, 1927. Pp. ix + 132. Price 4s. 6d. net.)

This little book is a study of the economic position of the small cultivator as contrasted with that of the wage labourer, based on a survey of 262 small holdings in Carmarthenshire and an examination of financial records kept by 93 of them, at the instance of the author, for a period of one year. The method of investigation was to forward a schedule of questions to the selected small holders and to follow this up with a personal visit, when the information supplied was supplemented by oral inquiry.

The author found that the Carmarthen small holders in general practise the same methods as their larger neighbours, and fail to specialize in those branches of farming that they might be expected to conduct not merely as well as, but even better than, the larger farmer. This fact must not be lost sight of when considering the conclusions to which the author's investigations led him, since it is on specialization that the small holder must commonly depend for real success.

Mr. Thomas's inquiries confirm the generally accepted opinion with regard to the superior stock-carrying capacity of the smaller holding (especially in regard to cattle, pigs and poultry), the greater employment of labour and the handicap suffered by the small holder in

consequence of proportionately heavier capitalization. Mr. Thomas remarks, however, that although the smaller holdings afford more employment than the larger, they supply no criterion of relative efficiency. Most of the small holdings are carried on without hired labour, and this exploitation of family labour is, in the author's opinion, not without serious social disadvantages.

From his analysis of the records of sales and purchases Mr. Thomas found that the balance of receipts per acre diminished as the size of the holding increased, but after allowing on the one hand for produce consumed, and on the other hand for interest on working capital and remuneration of the small holder and his family at ordinary wage rates, the general result showed an excess of expenses over income which, per acre, was greatest on the smaller holdings. Estimates of this kind are, of course, rather arbitrary, and seldom if ever enter into the calculations of the small holder himself. Nevertheless they have their value in helping to elucidate the question as to the most economic size of holdings of different types.

Appendices contain a bibliography, and comparative data for Denmark, Norway, Sweden and Switzerland drawn from official sources.

The Genetics of Sexuality in Animals. By F. A. E. Crew, M.D., D.Sc., Ph.D. Cambridge Comparative Physiology Series. (Cambridge: The University Press. 1927. Pp. 188, illustrated. Price 10s. 6d. net.)

The mantle of the prophet is not one which should be carelessly assumed, but one feels reasonably safe in saying that, in the future, Genetics will be the most important of all the sciences which have been called to the aid of agriculture. The basic aim of agriculture is not merely to produce food and other raw materials; it is rather to produce and maintain a stock or race of plants or animals which can be carried on from generation to generation, and which will yield their valuable products the while. Working only by experience and rule of thumb, husbandmen have achieved really remarkable success in breeding animals and plants, but there is a limit to the possibilities of these methods, and yet further improvement can be attained, as has been shown, for example, by the work of Luther Burbank, the "Plant Wizard."

Genetics, as a science, is only a quarter of a century old, and therefore one cannot expect it to revolutionize the practice of agriculture as yet, for research workers are still learning the grammar of this new knowledge. Very considerable progress has been made, however, and the implications of recent discoveries are far-reaching, and of the greatest importance. In his new book Dr. Crew treats of one side of the modern science of breeding, namely, the factors which underlie the determination and differentiation of sex, and brings out very clearly the new outlook which results from recent genetic discovery, and the hints of what it holds out for us in the future.

This volume is not one for the layman, or for those unversed in the technical terms of genetics and physiology, but it will prove most illuminating to those biologists, veterinarians or other specialists who already possess the necessary technical equipment, and to such it can thoroughly be recommended. The determination of sex and the subsequent sex-differentiation of organs are of fundamental importance to the economy of the animal, and the hitherto little understood mechanisms of these processes must be taken into consideration by the biologist who has to deal with the problems of modern agricultural practice.

It is now well established that sex is determined at the time of fertilization by the nature of the chromosomes of the egg and of the sperm which fertilizes it. This impress of sex is not limited to the

eggs or sperm which the animal will later produce, but is found in all the cells of the body. At a later stage in development a point is reached when the embryonic tissues begin to develop definitely the male or female characters, which up to this time have been indistinguishable. According to Dr. Crew this is dependent upon the already determined sex nature of the body cells acting in conjunction with the hormones produced by the reproductive glands. This hypothesis is substantiated by the consideration of a large number of very diverse cases of abnormality of development throughout the animal kingdom, and the interpretation is both economical and reasonable. Moreover, it is put forward in Dr. Crew's now well-known style of clear exposition and compact lucidity, which enhance the value of this monograph on a somewhat difficult subject in no small degree.

Animal Nutrition. By T. B. Wood, C.B.E., LL.D., F.R.S. Second Edition: pp. viii + 226. (London: University Tutorial Press, Ltd. Price 3s. 6d. net.)

This is a companion volume of another well-known text-book by the same author—*The Chemistry of Crop Production.* Just as the latter describes the scientific principles of cultivation, so the volume under notice deals with the utilization of the products of the soil for the feeding of animals. Primarily intended for students, the book will also prove invaluable to farmers who take an intelligent interest in the computation of rations for the various classes of stock. In this connexion, the author has adopted a system based on the results which the feeder desires to produce. For example, if the desire, with fattening cattle, is to produce a steady average gain in weight of about 2 lb. per head per day, the chapter on beef production shows how this object is to be attained. The rations are worked out in this way, not only for fattening cattle and for dairy cows, but also for sheep, and should appeal strongly to farmers at the present time, as they will be found to differ materially from those in general use in that they contain far less cake and meal.

The reference to the feeding of dairy cows on pasture is likewise of general interest. The author shows that a deep-milking cow on good, well-managed pasture will find all the nutriment she requires without the aid of concentrated feeding stuffs.

It is necessary to draw attention to certain arithmetical errors, as on pp. 159 and 191.

Baillière's Atlas of the Ox: Its Anatomy and Physiology. By T. G. Browne, M.R.C.V.S. Original plates by Georges Dupuy, M.D. (London: Baillière, Tindall & Cox. Price, 7s. 6d. net.)

Professor T. G. Browne has prepared this atlas of the ox with great care and has succeeded in presenting much information in a comparatively small compass. That part of the atlas which deals with anatomy is the best section. The author states that the work is intended primarily for veterinary and agricultural students as well as stockbreeders and those interested in meat inspection. Undoubtedly the agricultural student will find in the atlas all the information on anatomy and physiology that he is likely to require, but the needs of the veterinary student, who must be well informed in these subjects, are not likely to be met by the work, nor indeed by any other work of this nature.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Buechel, F. A.—The Commerce of Agriculture: A Survey of Agricultural Resources. (439 pp.) New York: John Wiley. London: Chapman & Hall, 1926, 18s. 6d. [338·9; 63.]

Agriculture and Food Supply in France during the War: Agriculture, *Michel Augé-Laribé*; Food Supply, *Pierre Pinot*. Carnegie Endowment for International Peace. New Haven: Yale University Press, 1927, $4. [63 (44); 338.1 (44); 338.9.]

Commission Internationale d'Agriculture.—XIIme Congrès International d'Agriculture, Varsovie 21 au 24 Juin, 1925. Vol. I (191 pp.), Organisation, etc., 1926; Vol. II (611 pp.), Économie Rurale, Production Végétale et Animale, 1927; Vol. III (427 pp.), Industries Agricoles, Experimentation et Enseignement Agricole, 1927. Varsovie. [63 (063).]

Jones, Anna M.—The Rural Industries of England and Wales. A Survey made on behalf of the Agricultural Economics Research Institute, Oxford. IV: Wales (xi + 123 pp.). Oxford: Clarendon Press, 1927, 5s. [63.193.]

Rural Industries Bureau.—Leaflet No. 28: Oxy-Acetylene Welding and Cutting Apparatus. (31 pp.) London: The Bureau, 3d. [63.193.]

National Institute of Industrial Psychology.—Report No. 2. An Investigation of Certain Processes and Conditions on Farms. By *W. R. Dunlop*. London: 329 High Holborn, W.C. 1, 1927, 2s. [331; 371.]

Ministry of Agriculture and Fisheries.—Report of Central Committee on Scheme for Establishing Scholarships and Maintenance Grants for the Sons and Daughters of Agricultural Workmen and others. (62 pp.) London: H.M. Stationery Office, 1927, 1s. 3d. [37 (42); 378.]

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NOTES FOR THE MONTH

The Fluid Milk Market*

THIS Report describes and analyzes the chief economic conditions which affect the marketing of fluid milk in this country. The author is Mr. R. B. Forrester, M.A., M.Com., Cassel Reader in Commerce in the University of London, who was invited by the Ministry to undertake the investigation and prepare an independent report.

The earlier chapters form an appropriate background to the general subject, and deal with the magnitude, localization, and variation of supplies, the various markets which utilize these supplies, and the problems connected with their assembly and transport from the farm. It is shown that there are six main centres of consumption in England and Wales, namely, Tyneside, Lancashire, the West Riding of Yorkshire, Birmingham and the Midlands, South Wales, and London. With the exception of the last-mentioned, they are, more or less, all local markets, obtaining their requirements, on the whole, from within a 50-miles radius. London, on the other hand, "pulls into its market area supplies from all over England south of a line from the Wash to the Mersey and east of the Gloucester, Birmingham and Warrington line."

Then follows an examination in detail of the methods, organization and facilities provided by the two chief forms of transport used in this country—road and rail. In recent years, road vehicles have played an increasingly important part in the transport of milk, the latest development in this form of transport being glass or enamel-lined tanks having a capacity of from 1,000 to 2,500 gallons. Two of the railway companies now contemplate the provision of a number of

* *Report on the Fluid Milk Market in England and Wales*, Ministry of Agriculture and Fisheries, Economic Series No. 16 : H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 6d. net, or 9d. post free.

waggon under-frames for carrying tanks of 3,000 gallons capacity.

The central theme of the Report is woven round the low consumption of milk in this country. With the majority of foodstuffs, it is generally conceded that demand largely depends upon quality taken in relation to price, and while it is shown that the quality of the bulk of the milk in this country is relatively good, there are certain aspects of the quality question which require special attention at the present time if the confidence of the community is to be gained. These are discussed very fully in Chapter IV, dealing with quality and the graded milk movement.

With regard to ordinary market milk, the Report contains a short résumé of the two forms of control which, in their present use, date back to 1875, when the Public Health Act and the Sale of Food and Drugs Act were passed. The former deals with the health and sanitary controls relating to milk, and, from it, has been elaborated the present milk code, the principal landmarks in which include the Milk and Dairies (Consolidation) Act, 1915, the Milk and Dairies (Amendment) Act, 1922, the Tuberculosis Order, 1925, and the Milk and Dairies Order, 1926. Special attention has, however, been devoted to the second form of control—that by chemical analysis—because of the difficulties inherent in the present law, relating to the chemical quality of milk, which embodies minimum limits of 3·0 and 8·5 per cent. of milk-fat and non-fatty solids respectively. If the percentage falls below either of these limits, it is presumed, until the contrary is proved, that the seller has been guilty of a wrongful act, and that such milk is not genuine; no distinction is made between the person who deliberately adulterates milk and one who sells genuine milk below the presumptive limits prescribed. The Report recognizes that this is a real difficulty to surmount, but it is emphasized that it is not in accordance with ordinary commercial procedure to prosecute in a criminal court for offences which are, in reality, of a civil nature.

In view of this defect of the present situation, three alternative suggestions are put forward by Mr. Forrester as directions in which change might take place. These are :—

(*a*) towards a legal minimum quality standard enforced by criminal procedure, together with special provisions against adulteration, if deemed necessary;

(*b*) towards a legal minimum quality standard enforced by purely civil procedure except in cases of adulteration, where criminal procedure would remain;

(c) towards trade standards enforced by the ordinary method of contracts, leaving cases of adulteration to be dealt with by criminal procedure.

Under the head of the "Graded Milk Movement," reference is made to unofficial descriptions, such as "nursery" milk, as well as to the official grades themselves, their commercial features and costs of production. Prominence is, however, given to a second aspect of the quality position, namely, the relation of milk grading to the fluid milk market as a whole. It is contended that the nomenclature should be such as to convey the right order of quality of the grades to the ordinary public, and that no system of grading seems satisfactory which does not accept, as its basic standard, ordinary market milk as controlled and recognized. An alteration of terms is, therefore, suggested in the Report on the following lines:—

> Market milk of sound quality would be the basic British grade to be known as Standard milk. Immediately above would come the present "Grade A," which would be termed Special Standard; the "Certified" and Grade A (T.T.) of the present system would be included in the highest grade, which would be known as Super-Standard.

Chapters V, VI, and VII of the Report are concerned more intimately with the relation to the fluid milk market of the producer, the distributor and the consumer, respectively. The first of these chapters describes the features which characterize the sale of milk, and reviews the origin, position and effect of what is popularly termed "the N.F.U. Milk Scheme," which, though originally a London price settlement, has gradually assumed the function of a guide to regional or district agreements of a similar nature. Its main object is one of price fixing, but it also attempts to correlate supply and demand so far as that is possible within the limits of collective bargaining. A summary of the characteristics of large-scale selling agencies in the United States is added.

The functions and methods of the different sections of the distributive trade are outlined in Chapter VI, in which it is shown that the urban wholesalers constitute the most influential class of traders in the fluid milk market, and that, in many large cities and towns, the great bulk of the trade is done by from 12 to 15 firms of the wholesaler-retailer and large retailer type.

In Chapter VII—The Consumers' Market—emphasis is laid on the low average consumption of just under one-third of a pint per head per day of milk in this country, as compared with the consumption in many other countries such as Switzerland, Sweden, Denmark, Norway, and the United

States. An interesting table of estimates of milk consumption in a number of towns provides some idea of the variation in the average daily *per capita* consumption of milk from one centre to another. The use of milk by the householder and by public authorities concerned with health and education also receives special notice, and attention is directed to the work of, and need for, publicity and advertisement in this field.

Finally, Chapter VIII presents the outlook in the fluid-milk market, and brings together, in summary form, the main issues dealt with in detail throughout the Report.

Suitably illustrated, and containing much useful information in the tables and appendices, the Report should be read by all interested in the dairy trade of this country.

* * * * * *

Desiccation of Sugar Beet for Sugar Manufacture

THE Ministry has recently issued a report* by Dr. B. J. Owen upon the investigations undertaken by the Institute of Agricultural Engineering into the desiccation (De Vecchis) process for producing sugar from sugar beet. This report is supplementary to previous reports,† and deals technically with the experimental work and the conclusions reached: it is fully illustrated. There are several technical appendices; one on the long series of attempts beginning in the eighteenth century to produce sugar from dried beet; and a final appendix on the treatment of effluents. The principal conclusions are summarized in non-technical language.

Previous investigators have maintained that it is possible to dry beet in such a way as not to give rise to the formation of invert sugar and of caramel in the process of manufacture. Dr. Owen's investigations have left him in no doubt of the

* *A Report on an Investigation into the Desiccation of Sugar Beet and the Extraction of Sugar—with a Note on the Treatment of Sugar Beet Effluents.* By B. J. Owen, M.A., D.Sc. Published by H.M. Stationery Office, 1927. Price, 2s. 6d. net.

† *Report of the Commission of Enquiry on the De Vecchis Beet Sugar Process.* [Cmd. 2343, 1925.] Price, 9d. net. Reviewed in this JOURNAL, April, 1925.

Investigations into the Desiccation (De Vecchis) Process for Producing Sugar from Sugar Beet. Progress Report by B. J. Owen, M.A., D.Sc. Published by H.M. Stationery Office, 1926. Price, 4d. net. Reviewed in this JOURNAL, October, 1926.

"Some Discoveries in the Treatment of Sugar Beet." By B. J. Owen, M.A., D.Sc., L. F. Manés, F.C.I.P.A., A.C.G.I., and J. L. Dougan, C.B.E., M.A. This JOURNAL, February, 1927.

possibility of this, although certain of the hypotheses put forward to explain the changes to which the beet is subjected would, in the light of his investigations, appear to be mistaken. The conclusion reached by previous investigators that the albuminoids present in beet are coagulated on drying was confirmed.

The desiccation process produces raw juices with a greater viscosity and greater relative concentration of impurities than the diffusion process. Means, therefore, have to be devised for overcoming the difficulties arising. Various methods were tried and two were found to be successful. The method finally adopted consisted of mechanically clarifying the juices either before or after liming, whichever is the more convenient. By this method, a good-class white sugar, was obtained. The other method, which also produced a white sugar, consisted in using, after liming, an activated carbon. Both methods of purification gave good results. The latter, though more expensive, gave a better yield of white sugar, as it was found that the green syrup obtained from the first strike of white sugar could be re-boiled to produce a second strike of white sugar. The syrup from the second strike produced a final molasses of low purity and a second product sugar which was available for re-melting into the raw juice.

* * * * * *

Markets and Fairs in England and Wales

THIS Report,* issued by the Ministry in the now familiar Economic Series, follows the general commentary on markets and market conditions in this country presented in Part I (Economic Series, No. 13). The Report now issued covers the 414 agricultural markets and auction marts and 250 agricultural fairs in the Midland Counties, and contains detailed information of a kind which the Ministry is frequently asked to supply. It will be recalled that the Linlithgow Committee recommended that detailed information regarding markets and fairs should be collected and published.

The Report is divided into three main sections. The first of these surveys in general terms the Midland markets, as a whole, from the standpoint of the commodities sold; thus live stock markets, corn markets, wholesale fruit and vegetable

* Economic Series No. 14, *Report on Markets and Fairs in England and Wales: Part II, Midland Markets.* H.M. Stationery Office, price 6d. net (post free, 9d.). To be obtained from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller.

markets, egg and poultry markets, meat markets, fish markets, cheese and butter markets, wool auctions, hide and skin markets and the numerous retail markets all receive a share of attention. A note as to the rents, stallages and tolls charged in the Midland markets follows, and the section ends with a review of the agricultural fairs which are held annually or at shorter intervals in the area covered by the Report. The agricultural fairs are gradually disappearing, although many linger on, chiefly as pleasure fairs. For reasons of sentiment, the disappearance from English country life of these pleasant, if boisterous, anniversaries may give cause for regret, but, from the point of view of the producer, there is no question that the properly equipped weekly markets which have taken their place offer greater convenience and efficiency.

Section 2 of the Report gives a series of brief sketches of the agricultural conditions of each county in relation to the markets within its administrative area. In all, 18 counties are reviewed, ranging from Bedfordshire and Gloucestershire in the south, to Lincolnshire and Cheshire in the north. Notes on a few markets of general or particular interest are included.

The third section will probably be regarded as the most informative part of the Report, as, in this section, a number of live stock, egg and poultry, and fruit and vegetable markets have been selected for description in some detail. This will enable those directly concerned with markets, either as owners, managers or users, to appreciate the special features of a number of important markets in various parts of the country. Taken as a whole, and read in conjunction with Part I (Economic Series No. 13), the Report may be said to provide a useful background for the investigation of a number of problems connected with markets, such as why one method of sale is practised in one place and a different method in another ; whether, in some parts, the markets—more especially the live stock markets—are not so numerous that concentration would be an advantage ; and whether, notably in the large centres of the population, the market accommodation is sufficient to meet the needs of the wholesale trade in agricultural produce. This section of the Report has been well illustrated with photographs and diagrams.

Printed as an Appendix to the Report is a complete list of the markets in the Midland area arranged alphabetically by counties. This appendix contains, for each market, information as to the market days, the market occupier, the covered and uncovered area of the market, the commodities sold, the

method of sale and other relevant data. The live stock markets are, further, classified according to turnover of stock. This appendix is a veritable "Bradshaw" of the Midland markets.

Other appendices contain a list of agricultural fairs, by counties, showing the dates when they are held and the commodities sold, and a list of cattle markets showing the total numbers of each class of stock handled in a recent typical year. Such comprehensive information has not previously been published on the subject of markets and fairs, and there is no doubt that the appendices give the Report distinct value as a permanent book of reference, essential alike for local authorities and their market committees, for auctioneers and other market owners, and for the larger public represented by farmers and buyers of every sort of agricultural produce and stock. The Report enables the farmer to see, at a glance, not only the status of nearby markets with which he is familiar, but also to ascertain information regarding markets at a distance which may offer alternative channels for disposing of his produce.

* * * * * *

Eggs and the Merchandise Marks Act, 1926

THE Report on Eggs of the Standing Committee under the Merchandise Marks Act, 1926,* leaves the reader in no doubt that the Committee were satisfied that a substantial amount of misrepresentation as to the origin of eggs does, in fact, take place. The Committee, however, see two dangers in a marking Order. First and foremost, they fear that, in the present unorganized state of marketing in this country, the balance of advantage would rest with the best classes of imported eggs. Secondly, they think that a requirement of marking would interfere with the imports of "cheap" eggs and so affect the cost of living of the poorer classes in the United Kingdom.

The Committee express the view that, before an Order is made, steps should be taken to improve home methods of marketing, and also to remove, or at least to reduce, the second of the dangers which they foresee. They recommend that, in the meantime, experiments should be continued with marking inks suitable for use upon eggs, and that the problem presented by preserved eggs should receive attention. It is

* Cmd. 2969, price 3d.: H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

clear, therefore, that the Committee, while reporting adversely to an Order in existing circumstances, feel that as soon as means can be found to overcome the two main obstacles, the question of marking might again come up for consideration.

* * * * * *

Proceedings under the Agricultural Credits Act

THE following Report of Proceedings under Section 2 of the Agricultural Credits Act, 1923,* from January 1, 1926, to March 31, 1927, was recently published :—

A Report of Proceedings under the above Act up to December 31, 1925, was presented to both Houses of Parliament on March 24, 1926.

As stated in that report, a total of nine Credit Societies had been formed under the Act up to the end of December, 1925. Of these Societies only two have materially extended their operations during the period under review. One Society is in an unsatisfactory financial position, and, notwithstanding the efforts of its committee, has had to face a number of bad debts. It has arrears of interest payments due to the Ministry. One other Society is also in an unsatisfactory position, but has maintained its interest payments throughout the period.

Only two Societies have been established since January 1, 1926, one of which has received no advances from the Ministry. Apart from these, very little interest has been taken in the facilities afforded under this Section of the Act ; in fact, the 15 months' experience from the beginning of 1926 has only confirmed the statement contained in the previous report as to the lack of interest shown by agriculturists generally.

The initial period of three years fixed by Section 2 (2) of the Act during which the Ministry was authorized to make advances to Credit Societies formed under the Act, expired on July 31, 1926. In view of the small extent to which advantage was being taken of the Act, and after full consideration by the Ministry, it was decided by the Treasury to extend the above period to March 31, 1927, but to bring the powers conferred by this Section to an end on that date. The existing Societies were accordingly notified of this decision.

Of the total sum of £440,000 transferred to the Agricultural Credits Account in 1923–24, £400,000 was surrendered on March 30, 1926. Of the remainder, £5,461 6s. 2d. had by March 31, 1927, been disbursed as " Expenses of the Ministry,"

* A summary of the provisions of the Act appeared in this JOURNAL, October, 1923, p. 649.

mainly as grants to the Agricultural Organization Society as described in the previous report, and £11,763 17s. 3d. represented the total advances to Societies, less refunds and repayments of interest. The balance of £22,774 16s. 7d. was accounted for by the surrender to the Exchequer of £15,414 9s. 1d. on November 20, 1926, and £7,360 7s. 6d. on June 1, 1927.

The following statement gives particulars of the Credit Societies formed since the passing of the Act:—

Name of Society	Date of registration	Amount of total advances under Sect. 2 (2) of the Act	Amount of repayment	Remarks
		£	£	
Bedfordshire Agricultural Credit Society, Ltd., 18 Bunyan Rd., Kempston, Beds.	29.1.24	—	—	Wound up. Has never operated.
Cornwall Agricultural Credit Society, Ltd., Restormel, Lostwithiel, Cornwall.	22.2.24	—	—	Has never operated.
East Hill Agricultural Credit Society, Ltd., East Hill Poultry Farm, Kemsing, Kent.	3.5.24	1,732 0	—	
East Sussex Agricultural Credit Society, Ltd., 197 High Street, Lewes, Sussex.	8.7.24	430 0	350	
Pillaton and District Agricultural Credit Society, Ltd., St. Odulph Cottage, Pillaton, St. Mellion, Cornwall.	11.8.24	—	—	Has never operated.
Furness and Cartmel District Agricultural Credit Society, Ltd., 3 Theatre Street, Ulverston, Lancs.	18.12.24	3,230 10	—	
Arlesey and District Agricultural Credit Society, Ltd., Arlesey, Beds.	11.2.25	2,105 10	45	
Addington Agricultural Credit Society, Ltd., Eldon House, Wellesley Road, Croydon.	5.2.26	—	—	
The Fur Board, Ltd., Bucklebury, Reading.	*2.2.26	5,000 0	—	

* Constituted a Credit Society by amendment of rules.

Marketing of Home Produce

ACCOUNTS have been given in this JOURNAL from time to time of the various activities undertaken by the Ministry with the aid of a grant of £40,000 a year for five years made by the Empire Marketing Board. The grant is for the purpose of carrying out further investigations into the marketing of home-grown agricultural produce and for demonstrating improved methods. A further brief report of progress for the quarter ended September 30, 1927, may prove of interest.

Publications.—No report was issued during the quarter, but considerable progress was made with Part II of the *Survey of Markets* (Midland Markets—Economic Series No. 14) and the *Report on the Fluid Milk Market* (Economic Series No. 16), both of which have since been published and are reviewed in these pages. A draft report on the pork and bacon trades (Economic Series No. 17) and a draft report on the marketing of wheat, barley and oats (Economic Series No. 18) are now under consideration. Part III of the *Survey of Markets* (Northern Markets—Economic Series No. 19) and a detailed report on the marketing of apples, pears and plums are in course of preparation.

During the quarter under review, over 2,500 copies of the Economic Series were sold, bringing the total sales of the Series up to September 30, 1927, to nearly 40,000.

Marketing Investigations.—Field work in connexion with the marketing of cattle, vegetables and cheese continues; inquiries are also being made in the eastern and southern counties in connexion with the Survey of Markets, the object being to prepare a report on the markets and fairs of that area.

Marketing Demonstrations and Displays of Empire Produce.—A considerable amount of work in both these directions was undertaken during the quarter and detailed accounts of this have already been given in this JOURNAL. Numerous applications have reached the Ministry for permission to use the experimental national mark. These have been noted pending further developments.

Grants-in-Aid.—A grant not exceeding £700 for the first year was sanctioned to assist the English Cheddar Cheesemakers' Federation in launching a scheme for the standardization and marking of farmhouse cheddar cheese; details of this scheme were given in this JOURNAL for October, 1927 (p. 595). It is satisfactory to record that both the Cheshire and the Cheddar Federations are making satisfactory progress.

Farmers are joining the Federations in considerable numbers; the trade-marked cheese is gradually establishing its market and commands a higher price than the best ungraded products.

A considerable amount of preliminary work on the experimental trial of pig recording mentioned in this JOURNAL for October, 1927 (p. 595), has been done during the summer by the School of Agriculture, Cambridge; the scheme commenced officially on October 1.

The Pershore Co-operative Fruit Market's scheme for marketing graded produce (see this JOURNAL for October, 1927, p. 595) has commenced, and reports indicate satisfactory progress.

The Cottenham Growers, Limited, have decided not to open their apple grading and packing station this year on account of the poor crop. The grant of £100, mentioned in this JOURNAL for July, 1927 (p. 292), will not therefore be made this year, but the Society has been informed that the offer will be renewed next year on the same conditions.

* * * * * *

Auction Prices for Apples in returnable and non-returnable packages

IN previous years it has always been interesting to note the difference in prices obtained at the Imperial Fruit Show for apples in non-returnable boxes and for the same quality fruit in returnable wickers.

The auction at the recent Imperial Fruit Show held at Manchester again demonstrates the buyer's readiness to pay more for high quality apples in non-returnables. Below are a few of the prices obtained for apples in (non-returnable) boxes and (returnable) wicker sieves.

	Boxes: Bramley Seedling		*Bushel Sieves: Bramley Seedling*	
	£ s. d.		s. d.	
Grower (*a*)..	0 11 6		7 0	
(*b*)..	0 13 3		10 3	
(*c*)..	1 1 6	(1st prize)	6 0	
(*d*)..	0 10 6		16 0	(1st prize)
(*e*)..	0 15 0		6 0	
(*f*)..	0 15 6		8 0	
(*g*)..	1 1 0	(1st prize)	7 0	
(*h*)..	0 10 9		12 3	(1st prize
(*i*)..	0 13 0		8 0	
(*j*)..	0 11 9		9 3	
(*k*)..	0 13 0		8 6	
(*l*)..	0 12 6		7 0	

Average per box, 14 1 Average per bushel, 8 9

In addition, the buyer is charged 2s. for the returnable sieve.

The boxes and bushels contained apples of identical quality, size and net weights, and in most cases were from the same grower and from the same trees.

Prices for " Newton Wonder " apples show exactly the same comparison as the above.

The old controversy as to the advisability of packing English cooking apples in the standard box should surely now be at an end, seeing that the comparison of prices for boxes and bushels has been on a similar level at the Manchester, Holland Park and Birmingham Shows.

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Inter-County Clean Milk Competition, 1926-27

THE distribution of awards to the winners of the Inter-County Clean Milk Competition for England and Wales, 1926-27, held under the auspices of the British Dairy Farmers' Association, took place at the Dairy Show on Wednesday, October 19, 1927. The prizes were presented by the Rt. Hon. Walter Guinness, Minister of Agriculture and Fisheries. It will be remembered that this Competition was instituted by the British Dairy Farmers' Association with the object of encouraging improved methods of milk production.* Eighteen counties entered the competition, of which 11 finally competed, and over 400 dairy herds were included; with one exception, these counties also held clean milk demonstrations and/or milkers' competitions.

Mr. Whitley (British Dairy Farmers' Association) in opening the proceedings commented on the great strides which were being made in the production of cleaner milk, largely due to the educational facilities offered by Local Education Authorities under the guidance of the Ministry. He observed that the winning county, Cornwall, had obtained nearly full marks in regard to the absence of bacterial contamination of the milk examined, and the high standard they had maintained throughout the competition made them very deserving winners.

The Minister, in presenting the prizes, congratulated the British Dairy Farmers' Association on their enterprise in having instituted this Inter-County Competition, and the committees of the Local Education Authorities on the work which had been carried out. He complimented Miss Nicholas (County Dairying Instructress for Cornwall) on the very high standard achieved by her county, which was largely due to her efforts. Commenting generally on clean milk production, the

* A Note on the Competition appeared in this JOURNAL for January, 1927, p. 881.

Minister said that, if people are to be encouraged to consume more whole milk, they must be convinced that the supply is clean; many of the public have already learned that clean fresh milk has very satisfactory keeping qualities, and in certain poorer districts to-day people with very little money to spare are prepared to pay for "graded" milk because of its keeping properties. The Minister went on to indicate the activities of his Department in the way of providing education and advice for milk producers, and said that last year over one thousand herds were entered in clean milk competitions held in thirty-eight county council areas. Nearly 30,000 cows were included in these competitions, and, of the milk examined, two-thirds reached the bacteriological standards required for "graded" milk.

Awards were made as follows:—

Winning County (Cornwall): The Stapleton Cup and B.D.F.A. Gold Medal.

Second County (Essex): B.D.F.A. Silver Medal.

Third County (Berkshire): B.D.F.A. Bronze Medal.

Leading Competitor in Cornwall Clean Milk Competition: (Mr. W. L. Pearce) £50.

Second Competitor in Cornwall Clean Milk Competition: (Mr. H. F. Pearce) £25.

Third Competitor in Cornwall Clean Milk Competition: (Mr. J. Downing) £10.

Head Cowmen of the above three competitors (Mr. W. A. Lee, Mr. H. M. Clayton, and Mr. E. Downing): £10, £8, and £6 respectively.

The Stapleton Cup will be held by Mr. W. L. Pearce for one year and the gold medal becomes his property; the silver medal becomes the property of the leading competitor in the Essex Clean Milk Competition, and the bronze the property of the leading competitor in the Berkshire Competition.

The system of marking may be indicated best by the following statement of marks awarded to the leading counties:—

COUNTY CLEAN MILK COMPETITIONS —		*Cornwall*	*Essex*	*Berkshire*
For each herd in excess of 50 ..	2 points	- -	22	- -
For each herd competing for first time	5 points	55	215	35
In a competition embracing not less than 20 herds, for each 1 per cent. of herds gaining not less than 75 per cent. of possible marks for *inspection*	5 points	477	270	409
Ditto for *Bacteriological Count*	5 points	500	303	409
Ditto for absence of *B. Coli* ..	5 points	454	295	386
Ditto for *Keeping Quality* ..	5 points	477	352	68
Ditto for *Fat*	1 point	100	90	95
Ditto for absence of *Sediment*	1 point	95	85	100

CLEAN MILK DEMONSTRATIONS—		*Corn-wall*	*Essex*	*Berk-shire*
On the relationship of the total number of attendances of *bona fide* farmers at clean milk demonstration to the total number of dairy farmers in the administrative area.				
For each 1 per cent.	10 points	74	473	134
MILKERS' COMPETITIONS—				
For each competition held in accordance with the Ministry's scheme	20 points	240	20	80
For each competitor gaining not less than 75 per cent. possible marks	5 points	1,180	45	135
LICENSED PRODUCERS—				
For each licensed producer of certified milk	5 points	5	20	30
For each licensed producer of Grade "A" (T.T.) milk ..	5 points	—	55	135
For each licensed producer of Grade "A" milk	3 points	45	102	—
For each producer taking out a licence for Graded milk for the first time, during the year of competition ..	5 points	25	55	10
Total number of points ..		3,727	2,402	2,026

The Inter-County Competition for the year 1927-28 is now in progress, and further particulars may be obtained from the Secretary, British Dairy Farmers' Association, 28 Russell Square, London, W.C. 1.

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THE ANTIQUITIES OF AGRICULTURE: A NOTE ON THE BRITISH MUSEUM EXHIBITION

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ON the occasion of the Imperial Agricultural Research Conference the British Museum arranged an exhibition, chiefly of printed books and manuscripts, illustrating the history of agriculture. This exhibition will remain on view until the New Year. The purpose of this article is to direct the attention of those who are interested in the history of agriculture, but who have not already seen the British Museum exhibits, to a collection which they are not likely to be able to view as a whole on any later occasion.

Ancient Egypt.—The range of exhibits actually covers about 5,000 years; but the extreme limit is represented by a single object, an archaic sickle of wood fitted with flint blades from the Fayum. This implement (Fig. 1A) obviously belongs to a world different from our own, a world without metal. A bronze sickle (of about 1000 B.C.) shown next to it (Fig. 1C), belongs to an age preceding our own, but in form it is the counterpart of implements in use to-day. The implements of tillage in Ancient Egypt were apparently evolved along lines rather different from those which determined the development of the plough in Western Europe. The primitive hoe-like implement, of which a specimen is shown (Fig. 1B), was developed into the plough, by a simple enlargement of its parts and the extension of the handle into a beam. The plough is shown in a vignette (Fig. 2) from the Funerary Papyrus of a royal scribe, Ani (fifteenth century B.C.), which also shows the harvesting of corn with the sickle and threshing by the treading of oxen on a circular threshing floor.

Fruit-culture played an important part in Egyptian agriculture. A vignette (Fig. 3) from the Funerary Papyrus of a military scribe, Nakht, shows the cultivation of the date, the fig and the grape. These are grown in a garden surrounding a tank. In such gardens, the soil of which was almost pure sand, pits were dug and filled with Nile-mud: Nile-mud provided also the material for rimming these pits with a low bank, which enabled them to be flooded from time to time.

The work of cultivation was performed by the fellaheen. Their lot is illustrated by a papyrus containing part of the

teaching of Duauf and by several "Shauabti" figures[1] (Fig. 4). Duauf, some 2,000 years or more B.C., wrote a book of advice for his son Pepi, in which he extolled the virtues of learning and the superiority of the scribe's profession. He describes the endless toil of the peasant, which is followed by the interminable settling of accounts with the steward.[2] We are reminded of the picture of the ploughman in the Colloquies of AElfric—also a work of instruction—in the eleventh century of our era. "Mighty hard work is it," says the English ploughman, "for I am not free." He had to contend with bitter cold and frozen fields, the Egyptian fellah with burning sun and parched sand: their lot in this world was one.

Greek Agriculture.—We know only the broad lines of primitive Egyptian agriculture. Before the end of the fourth century before Christ, Greek influence became strong in consequence of the Macedonian conquest, and Egypt entered fully into the common Mediterranean civilization which we call classical. Greek thought and Greek science dominated classical civilization; and it survived for many centuries until, firstly, the barbarian invasions and, secondly, the Mohammedam conquests reduced it to the ruin which Europe had slowly and painfully to reconstruct. Of Greek agriculture and of agricultural administration under the Ptolemies and the Romans many witnesses remain in the documents written upon papyrus and preserved in ruins, rubbish heaps, and cemeteries in the dry soil of Egypt.

When we try to reconstruct that past life, as papyri such as those in the present exhibition enable us to do, we cannot fail to be struck by the modern air it wears. Irrigation has, of course, always been essential to Egyptian agriculture, and it is but to be expected that there should be many references to the ways and means of getting Nile water on to the arid land. For the work of constructing and repairing dykes personal labour appears to have been demanded, just as personal labour was demanded in mediæval England for the maintenance of dykes constructed for draining fens: but, by the third century A.D., money payments were beginning to be substituted, just as a rate or cess was substituted for personal

[1] These, representing fellaheen, were buried with the dead, their purpose being to perform tasks demanded of the dead men in the nether world. They hold in their hands agricultural implements: one here shown has a basket slung over his left shoulder.

[2] *Guide to Exhibition Illustrating the History of Agriculture*, p. 8.

To face page 800.

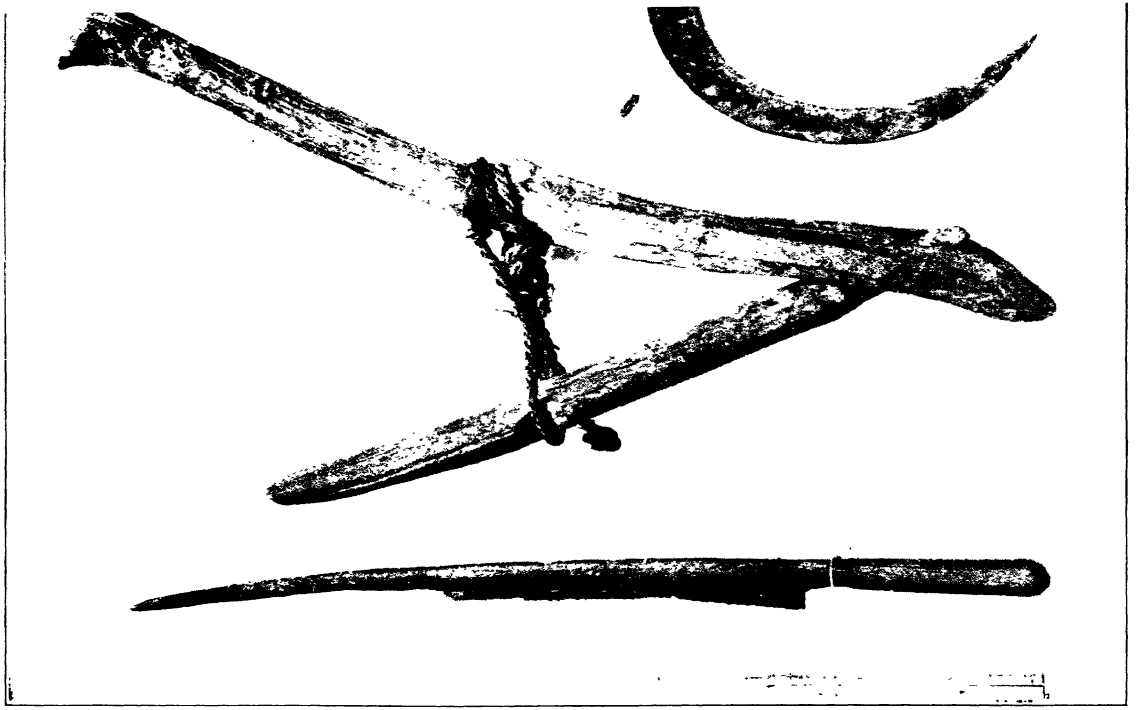

FIG. 1.—Primitive Agricultural Implements from Egypt: (*a*) Sickle, before 3000 B.C.; (*b*) Hoe or Digging Implement, *c.* 1500 B.C.; (*c*) Bronze Sickle, *c.* 1000 B.C.

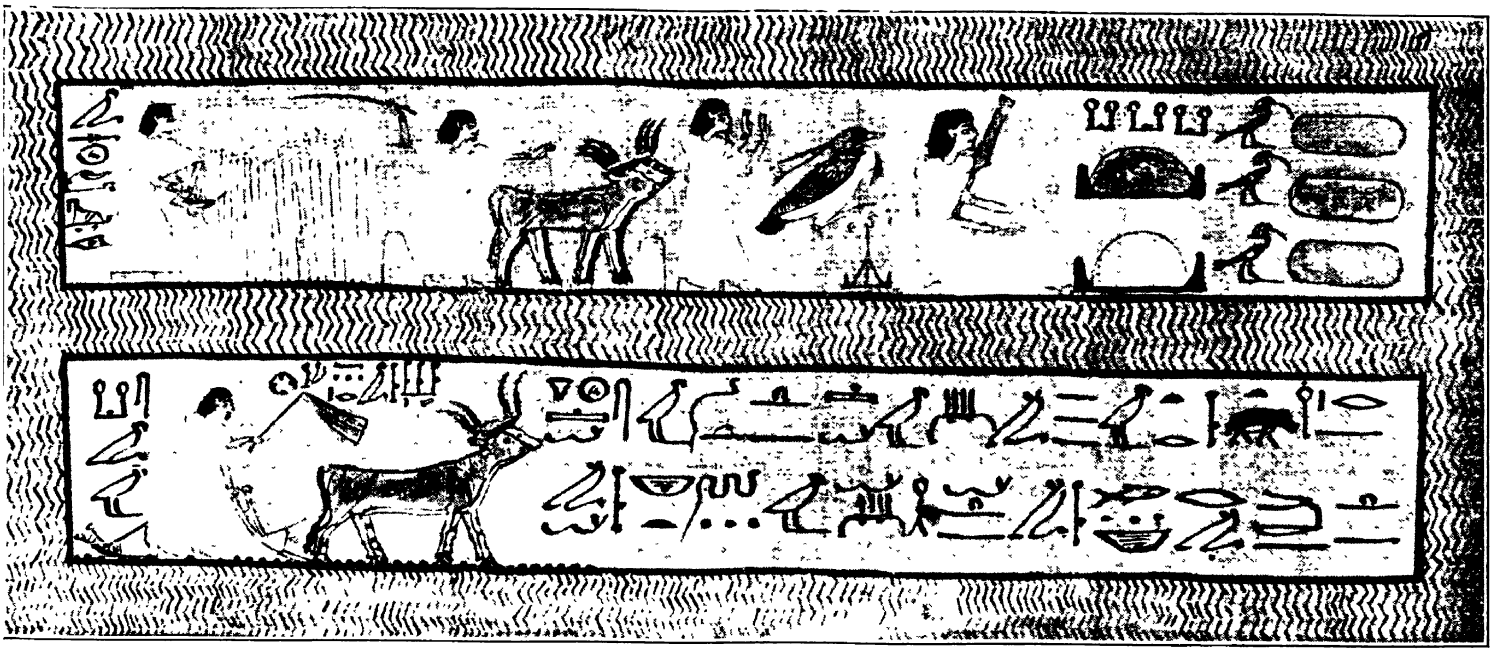

FIG. 2. - Part of Vignette from Funerary Papyrus, XVth century B.C., showing harvesting, threshing and ploughing.

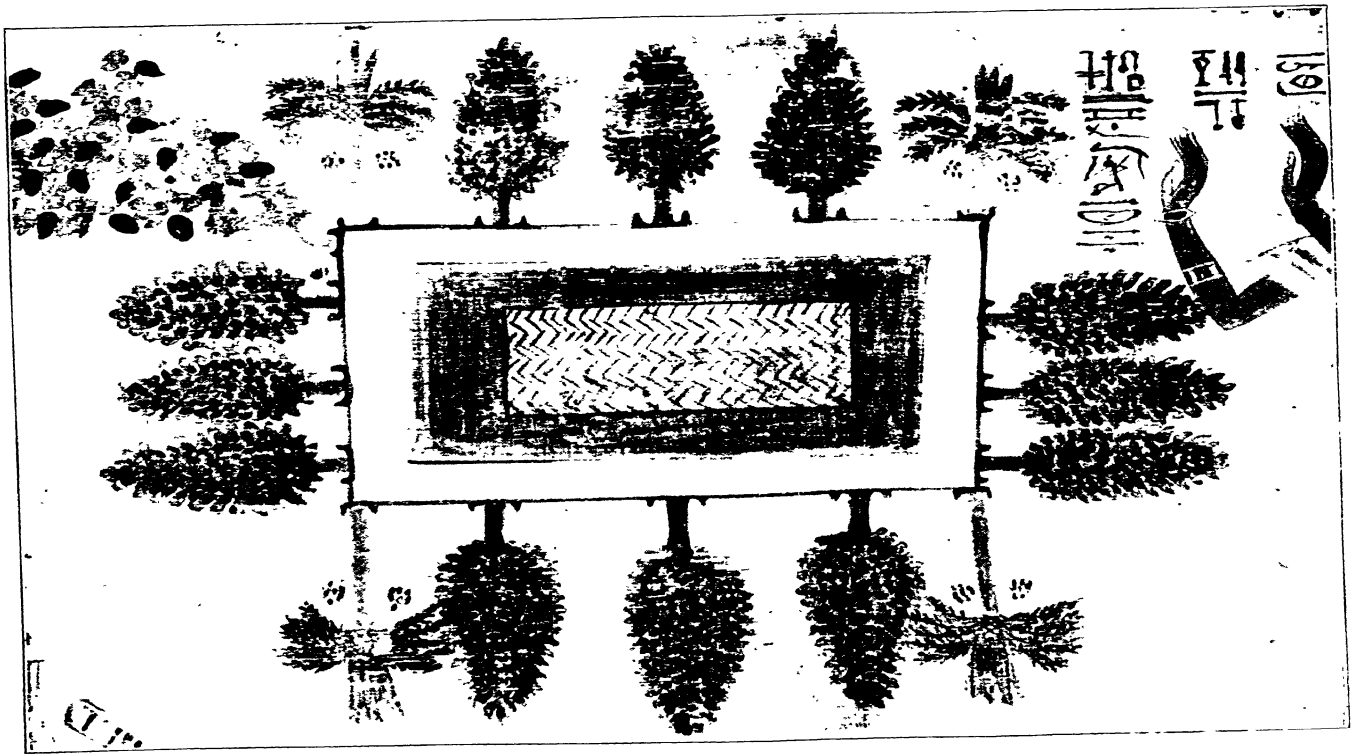

FIG. 3.- Part of Vignette from Funerary Papyrus, XIVth century B.C., showing fruit-cultivation.

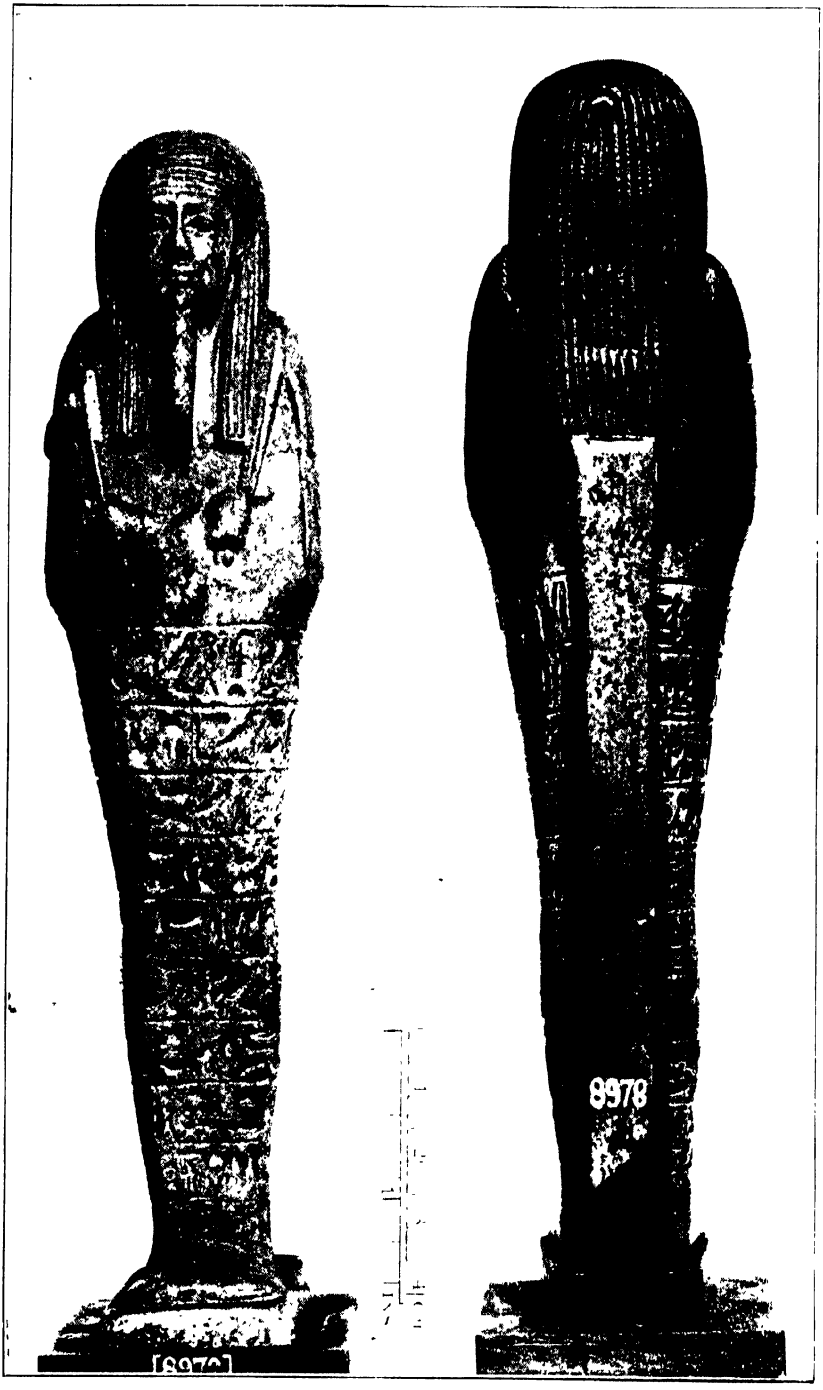

FIG. 4.—Shauabti figures holding agricultural implements

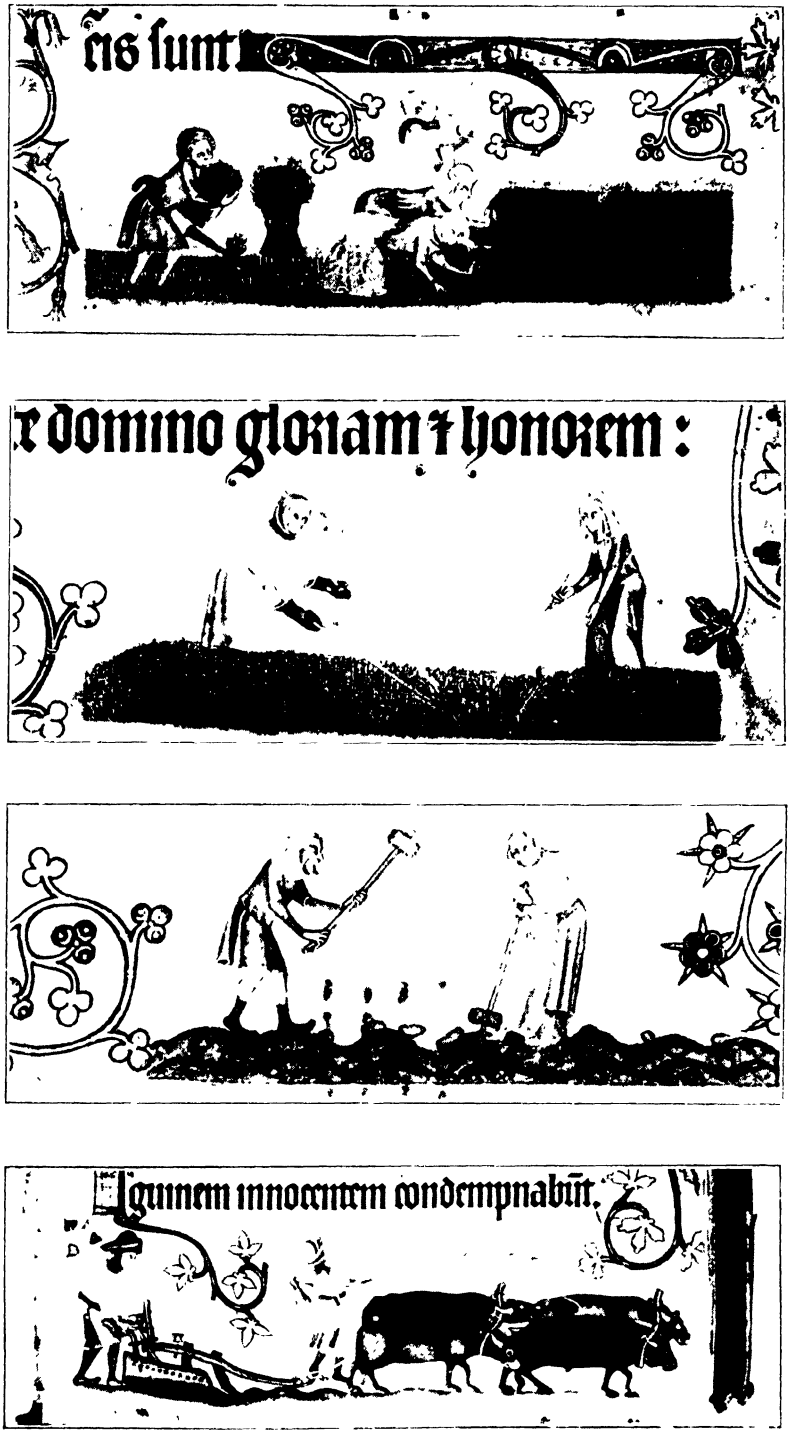

FIG. 5.—Four miniatures from the Louterell Psalter, *c.* 1340 A.D., showing (bottom to top) ploughing, clod-breaking, weeding, harvesting.

FIG. 6.—Frontispiece to the earliest English printed book on horticulture (?), 1525 A.D.

Fig. 7.—Miniature from King's MS. 24, showing Italian plough, *c.*1500 A.D.

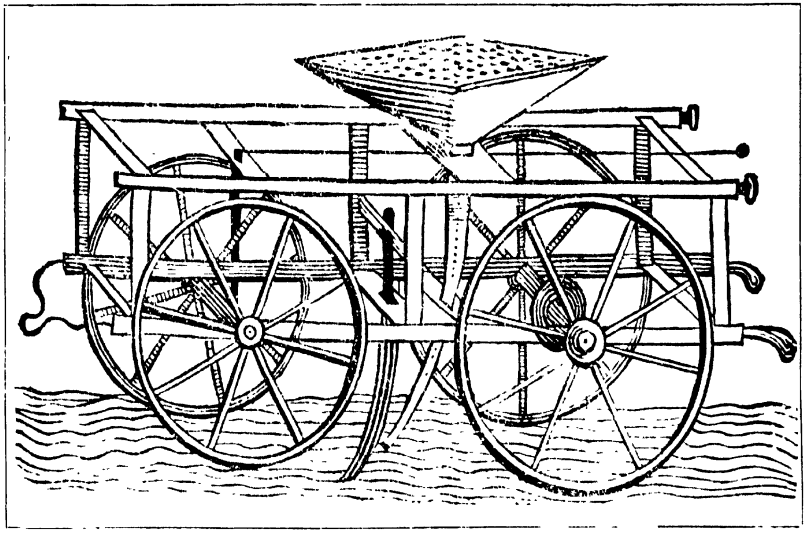

Fig. 8.—Drill designed by John Worlidge, 1675 A.D.

services in England. An interesting letter[3] of the year 278 requires the overseers to compel everyone to "perform his proper work by personal service . . . so that the dykes are raised to the ordained height and breadth and the breaches are filled up, in order that they may be able to withstand the flood of the most sacred Nile auspiciously approaching, and that the canals are cleansed up to the so-called standards and the usual width, in order that they may easily contain the coming influx of water for the irrigation of the fields, this being for the common weal, and that absolutely no money is exacted from any one in place of work."

Other parallels, but to a later England, are provided by leases from about the year A.D. 200. In one,[4] allowance is made in the rent in the event of the failure of the annual inundation of the Nile: in two others[5] there are restrictive covenants—one prohibiting woad and coriander, and another safflower. Proposals for an annual tenancy of a fruit farm in A.D. 280[6] provide for a rent in kind and also for payments to the tenant in money, wheat and wine for certain work to be carried out: this arrangement is similar to *métayage* which became not infrequent in Byzantine times. A lease providing for what is unmistakably *métayage* comes from the sixth century A.D.[7]: by then the economic position, particularly of the peasant, had worsened in the Roman world, but it is well to remember that the system still prevails in some parts of the Mediterranean region.

References to live-stock returns from the first and second century of our era[8] remind us that Government regulation is no new thing: another reference to an agricultural expert—from the third century B.C.[9]—reminds us that scientific agriculture has its roots deep buried in the past. And then farm accounts,[10] and documents concerning labour disputes[11] and destructive pests,[12] remind us that to-day we are confronting the same problems as this vanished civilization.

Parallels cannot, of course, be pushed too far. The careful evaluation of grain in terms of wheat, contained in two documents of the third century,[13] bears witness to a mode of thought which we hardly share: it suggests, too, the influence of a much greater uniformity in climatic conditions than we enjoy, although the mediæval assize of bread shows that the same ideas may be

[3] *Guide*, pp. 12, 13. [4] *Guide*, p. 11. [5] *Guide*, pp. 11, 12.
[6] *Guide*, p. 13. [7] *Guide*, p. 10. [8] *Guide*, p. 15
[9] *Guide*, p. 14. [10] *Guide*, pp. 14, 15. [11] *Guide*, p. 14.
[12] *Guide*, p. 15. [13] *Guide*, pp. 10, 15.

evolved under very different economic and geographical conditions. The Egyptian ratio is of interest: wheat, barley and spelt were esteemed in the ratio of 5 : 3 : 2; dredge (a mixture of barley and wheat) is half as valuable as wheat (the ratio is actually 17 : 9); poppy-seed is twice as valuable, and sesame six times as valuable as wheat.

Mediæval Agriculture.—The state of mediæval agriculture is illustrated by a number of miniatures, by manuscripts, and indeed by the early printed books on agriculture, for truth to tell agriculture was still mediæval even in seventeenth century England. The last vestiges of villenage had then only just disappeared, and the day of modern invention had only just dawned.

The implements employed in the Middle Ages were of the simplest, and the methods traditional. The oldest illustrations shown in the exhibition are the eleventh century drawings in two English manuscripts in the Cottonian collection.[14] The miniatures in the fourteenth century Louterell Psalter, from which the illustrations here reproduced are taken (Fig. 5), are representative of the whole of the Middle Ages. There is evidence that in the thirteenth century a movement had started for the improvement of agriculture, and on a certain number of estates cultivation was probably brought to a point of efficiency as high as was possible with the existing tools, and in the existing social environment. It was a common-sense efficiency, but it was not a scientific efficiency. Such handbooks as that of Walter of Henley[15] do not go beyond the elements of management; his stock of knowledge is that of a good craftsman; his outlook is not that of a man of science. Such science as the mediæval world had was derived from the agricultural writers of Rome—Palladius, Columella, Cato and Varro.[16] Palladius was translated into English verse in the fifteenth century: but he had really little to tell the English farmer, who drew his instruction from the best practices in the world about him. For in that world there was a good deal of practical good sense, and the standard of cultivation was maintained. The idea that the later Middle Ages experienced a diminution in fertility is a misconception based upon no evidence whatsoever.

The narrowness of the farmer's resources is suggested by the inventory of dead stock in the hands of the bailiff of Kingstone

[14] *Guide*, p. 19. [15] *Guide*, p. 16. [16] *Guide*, pp. 16, 21.

Manor (Hereford) in the early fourteenth century.[17] There are three carts and two ploughs, a fork, a spade, some mattocks, corn sieves, a winnowing fan, and much miscellaneous equipment. This list is perhaps not fully representative : but even the best equipped manor would have very few implements not mentioned here.

Local circumstances inevitably reacted upon the design of implements. FitzHerbert, whose book upon *Husbandry* was the first agricultural treatise to be printed in England,[18] mentions the different types of plough used in different districts, and attempts to give reasons for their differences in design. It is clear that the problem of draught had long attracted attention, as indeed it was bound to do : but the process of trial and error had not led to a great understanding of plough design. The few other implements at the farmer's command seem not to have attracted even the little scientific curiosity that expended itself upon ploughs. Hand-tools, however, had been perfected by use, and mediæval drawings and early printed books[19] represent even in small details the tools we find to our hand to-day.

Invention and Inquiry.—The seventeenth century saw the beginning of mechanical invention and carried further the advocacy of manures. Edward Maxey's *New Instruction of Plowing and Setting of Corne* (1601) introduced the idea of drilling[20] : he was followed later in the century by John Worlidge, who designed (Fig. 8) a "new instrument for sowing of corn."[21] Jethro Tull made a further advance, although he is best known by his advocacy of "horse-hoing."[22] The eighteenth century saw the introduction of superior ploughs and the first organized attempt to minimise the labour of old-fashioned ploughing.[23] In the meantime the range of crops had greatly extended, and by the time of Arthur Young, the art of husbandry as practised by the best farmers was widely removed from the practice of the Middle Ages, although many farmers were still to be found whose minds and ways belonged to the past.

[17] *Guide*, pp. 16, 17.

[18] *Guide*, p. 22. See also Plate I in *Guide* for a Flemish plough, *c.* 1500, and Fig. 7 for an Italian plough of the same period. The wood block illustrating FitzHerbert's *Husbandry* (see *Guide*, Plate V) presumably represents one of the types of English plough in use at the same period.

[19] See Plates II and IV in *Guide*, and Fig. 6.

[20] *Guide*, p. 24. [21] *Guide*, p. 26. [22] *Guide*, p. 27.

[23] See JOURNAL OF MINISTRY OF AGRICULTURE, Vol. XXVIII, pp. 1086 *ff*.

Before the end of Arthur Young's life, all the books represented in this exhibition had been written and printed. The great development of mechanism and of scientific farming was yet to come: but the spirit of inquiry, which was the essential basis of all improvement, is manifest in the writings of the second half of the eighteenth century and the beginning of the nineteenth.

There are here presented specimens of the books of every considerable English agricultural writer, and indeed of some inconsiderable writers who yet have a place in the history of agriculture. The *Guide* which the British Museum has published is by no means a lifeless list of books. It is extremely well illustrated; and he must indeed be learned in the history of agriculture and agricultural writers who can learn nothing from it. We are apt to treat a book as a book and nothing else, and forget that our business is with the writer of it. It is useful to be reminded that of Thomas Tusser it was said that none was better at the theory or worse at the practice of husbandry.[24] And are we not the better able to judge William Ellis's *Modern Husbandman* when we know that he was the last to follow his own counsel: "Be yourself the first man up in a morning for sounding at your door your harvest horn to call your men at four o'clock"?[25] And again, do we not appreciate the better the real greatness of Arthur Young for his criticism of his own early *Farmer's Letters to the People of England* as an example of "ignorance follow and presumption"?[26]

Any student of the history of agriculture will be wise not only to see the exhibition at the British Museum but to have the *Guide* under his hand after the exhibition is closed. The excellent list of documents and books, the valuable notes and worthy illustrations (none of them reproduced here), make the *Guide* a permanent possession; it is a wonderful shilling's-worth.

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[24] *Guide*, p. 23. [25] *Guide*, p. 28. [26] *Guide*, p. 29.

THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1926-27

SEEDS may be said to be the foundation on which the farm and garden crops of the country are based, and if, owing to wrong description or poor quality, that foundation is faulty, the whole structural work of a season, with its expense, its labour and its anxieties, is in jeopardy. A heavy responsibility, therefore, rests with the seller of farm and garden seeds. We are fortunate in this country in having a Seed Trade, the great majority of the members of which fully realize their responsibilities in this connexion and have established a reputation for fair and honest dealing. As in all trades, however, there are the few black sheep who, anxious for immediate profit, are careless of the results of selling poor quality seed. There are also those who, ignorant of the complex character of the article with which they are dealing, store, handle and sell seed much in the same way as they would deal in nails or any similar inanimate and more or less indestructible material. It is in order to protect the farmer and gardener from the machinations or carelessness of the one class or the other that the Seeds Act, 1920, was brought into operation.

Although the necessity of delivering a prescribed statutory statement in the case of every sale may be somewhat irksome to the reputable seedsman, the Act merely requires him to declare particulars about which, before the passing of the Act, he rarely failed to satisfy himself, even though he did not in every case set them out in the form of a detailed guarantee. The duty of bringing the irresponsible sellers of seeds into line with the more conscientious of their fellow-traders, even though it be supported by the penalties imposed on the wrongdoers by legislation, is a slow and arduous task. It is, however, confidently believed that much has already been done in this direction, and that the operations of the Seeds Act have resulted in a general improvement in the quality of the seeds marketed in this country. Odd as it may appear, the most difficult people to bring into conformity with the requirements of the Act are those to whom it offers the greatest advantage and protection.

Farmer to Farmer Sales.—The farmer to farmer sale still remains the most difficult problem of those responsible for the administration of the Act. That quantities of seed are sold each year in this way, and that probably a large proportion

of these transactions do not comply with the requirements of the Seeds Act, are, unfortunately, facts that must be acknowledged. The Ministry is, however, doing everything that is possible with the resources at its command to bring home to the selling farmer his responsibilities under the Act, as well as to the purchasing farmer the advantages he derives from getting properly tested seed. Paragraphs are inserted in the Press and in the agricultural journals; leaflets and circular letters are issued to farmers direct from the Ministry or from its local Inspectors or through the good offices of the National Farmers' Union; lectures are delivered to farmer audiences; immediate contact, either by letter or personal interview, is made with every farmer who advertises in the local newspaper that he has seeds for sale; exhibits illustrative of the requirements of the Act and the advantages of buying good seed are staged at more than 100 agricultural shows each season, etc. As a result of these steps, the position is undoubtedly showing signs of improvement, but it is realized that, without a considerable increase in staff—which the Ministry does not consider justified by the circumstances, even if the resources of the country permitted—it will always be a difficult matter adequately to control farmer to farmer sales.

Farmers' Samples.—Special steps have been taken during the past season to encourage farmers to make greater use of the facilities offered at the Official Seed Testing Station, particularly for tests of seed which they are proposing to sow themselves. These tests, for which only a nominal fee of 6d. per sample is charged, are not valid for use as a declaration under the Seeds Act in the case of a sale, but they are as full and complete as those carried out, at higher fees, for the use of the seller of seeds. There is a slow but steady increase in the number of these sixpenny tests, but, even so, the total is far from satisfactory. During the 1923-24 season, for instance, only one "farmer's sample" was received at the Station for every 20 samples received from seedsmen and others requiring a report for sale purposes. During the past season this proportion has improved to the extent of one "farmer's sample" for every 13 sale samples. It is noteworthy, too, how the number of farmers using the Station varies with the district. For instance, in 1926-27, 37 per cent. of the farmers using the Station for information tests resided in Anglesey, Devon, Hereford, and Kent, whilst from some counties no samples at all were received. The co-operation of a number of County

Agricultural Organizers is being secured in a scheme under which the Organizer acts as a collector of farmers' samples in his county. The samples are sent by the Organizers to the Station and the reports on the tests are returned to the Organizer for distribution and for the collection of the fees, the latter being forwarded to the Station in a lump sum at the end of the season. It is hoped in this way to overcome the apparent disclination of many farmers to send samples direct to the Station.

Visits to Seedsmen.—During the season 1926-27, some 8,000 visits were paid to seedsmen's premises by inspectors of the Ministry: practically the same number as that of the previous season. Of these visits, 1,500 were to establishments mainly of the type where seeds are sold only as a side-line—generally of a seasonal character—to the normal business, and which had not been called on previously. It was found that in the main the regulations were being carried out in a satisfactory manner, and it seems clear that the requirements of the Act are now a settled and recognized part of the seedsmen's business.

Control Sampling.—1,845 samples of seed were taken on seedsmen's premises during the season for check testing at the Official Seed Testing Station—an increase of some 350 over the number of samples drawn for this purpose in 1925-26. These samples included 281 of clovers, 170 of grasses, 31 of field seeds, 177 of roots, 612 of vegetables, 96 of cereals, and 478 of packeted seed. In the case of 64 of these samples, apart from packeted seed, the check test showed that the seller's declaration was seriously incorrect in a material particular. These included 4 samples of grasses, 21 of clovers, 1 of field seeds, 2 of roots, 29 of garden, and 7 of cereals. In 14 cases the germination was shown to be incorrect to the extent of from 10 to 15 per cent., in 7 cases from 15 to 20 per cent., and in 18 cases the discrepancies amounted to over 20 per cent. In 4 cases the purity was from 3 to 5 per cent. out, and in 4 others from 5 to 10 per cent. In the other cases the principal sources of error were the omission to declare the presence of injurious weed seeds or dodder. Taken as a percentage of the total number of control samples drawn, the discrepancy cases represent 4·7 per cent., as compared with 6·6 per cent. in 1925-26, 7·7 per cent. in 1924-25, and 11·5 per cent. in 1922-23. This steady decline in the number of discrepancy cases provides most satisfactory evidence of the improvement in the accuracy of the sellers' declarations.

Packet Seed.—In the case of packeted seed, the standard of accuracy during 1926-27 showed a slight falling off as compared with that of the previous season. Of the 478 samples taken, 94·8 per cent. were shown by the check tests to be at or above the minimum percentages of germination and purity laid down by the Regulations, as compared with 95·5 per cent. in 1925-26. Even so there was a satisfactory improvement over earlier seasons, the corresponding percentage in 1924-25 being 94, and in 1923-24, 90·6. Of the samples taken in 1926-27, 2·5 per cent. were below the minimum percentages of germination and purity but above two-thirds of those figures, and 2·7 per cent. were below two-thirds of the minimum. In this connexion, and regard being had to the difficulties which arise each season through the rapid loss of vitality in packet seeds, more especially in the case of onions and brassicas, a special series of investigational tests was carried out at the Official Seed Testing Station during the season.

Control samples of four bulks of vegetable seeds were kept under normal storage conditions at the Station, and portions were tested at intervals of a month. A wholesale seed house kindly undertook to distribute packets from the same bulks to six of its agents. The packets distributed were placed under exactly the same conditions as those under which such seed would normally be kept for sale by the retailer in question. Sample packets were drawn from each retailer at monthly intervals and sent to the Official Station where they were tested simultaneously and under identical conditions. While no very definite conclusions can be drawn from the results of the tests so far made, there are indications that a continuance of investigations along these lines will produce useful information. It is already seen that onion seed of comparatively low germination, that is, just above the minimum of 60 per cent. laid down in the Seeds Regulations, may lose vitality very rapidly when put up in packets. It is also clear that the conditions of storage have a considerable bearing on the loss of germination in the case of such seed. Further experimental work in this connexion is being continued.

Licensed Private Seed Testing Stations.—In a few cases the terms of the licences issued by the Ministry to private stations to test seed for the purposes of the Seeds Act have been altered during the season by extending or restricting the number of kinds of seed that may be tested under the licence. Four licences have been surrendered and four new ones issued,

the total number of licensed stations remaining unchanged. Some 1,300 special samples were drawn at these stations during the season for check testing at the Official Seed Testing Station. These included 286 samples of cereals, 99 of grasses, 327 of clovers, 303 of field and root seeds, and 290 of vegetable seeds. Wherever any marked discrepancy was shown between the result obtained at the private station and that of the Official Station, the matter was fully investigated to ascertain the reason for the variation. The bulk of the discrepancy cases were in respect of samples of mangolds and beets, the Official Station obtaining appreciably higher germination results than the private station in 33 of the 117 samples taken. It is suggested that the reason for this is that the Official Station is better equipped for this class of testing than the average private station. There were also a number of cases in which the Official Station obtained higher germination figures for samples of peas and beans. Variations beyond the prescribed limits occurred with some of the brassica samples, due largely to the poorness of the seed, which made the testing more difficult than usual. It is satisfactory to note that the clover and grass samples gave exceptionally uniform results. In addition to the above check samples, the usual series of "Referee" samples were issued to the private stations during the season. These included uniform samples of cocksfoot, red clover, trefoil, mangold, swede, and tares. The results of the tests on these samples, as compared with similar tests carried out at the Official Station, were more uniform than in any previous year. The results of all these check tests indicate that, on the whole, the standard of work at the private stations is now much higher than when they were originally established.

Training and Examination of Seed Analysts.—The sixth course of training for Seed Analysts was held at the Official Seed Testing Station, Cambridge, from June 28 to July 26, 1927. Twelve analysts attended the course, and all exhibited considerable keenness in the work. At the end of the course fourteen candidates sat for an examination, eleven being awarded a pass certificate.

Seed Analysts' Conference.—On July 29, the Fifth Annual Conference of Seed Analysts was held at the National Institute of Agricultural Botany, and was attended by a large number of seed analysts and others. The Chief Officer of the Official Seed Testing Station reviewed the results obtained at the private licensed stations on the series of referee samples

Packet Seed.—In the case of packeted seed, the standard of accuracy during 1926-27 showed a slight falling off as compared with that of the previous season. Of the 478 samples taken, 94·8 per cent. were shown by the check tests to be at or above the minimum percentages of germination and purity laid down by the Regulations, as compared with 95·5 per cent. in 1925-26. Even so there was a satisfactory improvement over earlier seasons, the corresponding percentage in 1924-25 being 94, and in 1923-24, 90·6. Of the samples taken in 1926-27, 2·5 per cent. were below the minimum percentages of germination and purity but above two-thirds of those figures, and 2·7 per cent. were below two-thirds of the minimum. In this connexion, and regard being had to the difficulties which arise each season through the rapid loss of vitality in packet seeds, more especially in the case of onions and brassicas, a special series of investigational tests was carried out at the Official Seed Testing Station during the season.

Control samples of four bulks of vegetable seeds were kept under normal storage conditions at the Station, and portions were tested at intervals of a month. A wholesale seed house kindly undertook to distribute packets from the same bulks to six of its agents. The packets distributed were placed under exactly the same conditions as those under which such seed would normally be kept for sale by the retailer in question. Sample packets were drawn from each retailer at monthly intervals and sent to the Official Station where they were tested simultaneously and under identical conditions. While no very definite conclusions can be drawn from the results of the tests so far made, there are indications that a continuance of investigations along these lines will produce useful information. It is already seen that onion seed of comparatively low germination, that is, just above the minimum of 60 per cent. laid down in the Seeds Regulations, may lose vitality very rapidly when put up in packets. It is also clear that the conditions of storage have a considerable bearing on the loss of germination in the case of such seed. Further experimental work in this connexion is being continued.

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which had been issued during the 1927 season. Professor Mercer, of the North Ireland Official Seed Testing Station, contributed a paper on the atmospheric conditions affecting purity tests; Mr. M. A. S. Sutton one dealing with the rate of imbibition of *Trifolium incarnatum*; Mr. F. H. G. Neale, of Messrs. Sutton and Sons, dealt with the germination of lettuce; Mr. R. Finlayson and Mr. C. C. Brett, both of the Official Seed Testing Station, also contributed notes on some seed analysts' problems and on loss of vitality in certain agricultural seeds, respectively. During the afternoon the British Association of Commercial Seed Analysts held its annual meeting.

"Seed Analysts' Bulletin."—Four issues of this Bulletin, containing various items of general interest to seed analysts, such as notes on new methods of testing, results of special investigations, work at the Official Stations, the administration of the Seeds Act, foreign seed regulations, etc., were made during the period under review.

International Seed Testing Congress.—The Fifth International Seed Testing Congress, which it was intended to hold in May, 1927, and which was of necessity postponed, will now be held, together with the general assembly of the International Seed Testing Association, at the International Institute of Agriculture, Rome, from May 16 to 19, 1928. The representatives of this country at the Congress will be the Chief Officers of the English, Scottish, and North Irish official seed testing stations.

Seed Wheat Survey.—In order to obtain reliable information as to the quality of the seed wheat sown in the Eastern Counties, a series of special samples was drawn "from the drill" on farms in that area during November, 1926. Owing to various circumstances, it was not found possible to secure as many samples as was hoped, nevertheless the inquiry brought out some interesting particulars. For instance, the first four varieties in order of popularity appeared to be (1) Yeoman and Yeoman II together (34 samples); (2) Squarehead Master (20 samples); (3) Little Joss (15 samples); (4) White Victor (11 samples). As regards the extent to which home-saved seed is used, the proportions worked out as follows:—

(*a*) Purchased from merchant or seedsman	..	48 samples.
(*b*) Home-saved seed	55	,,
(*c*) Purchased from neighbouring farmer	..	14 ,,

The prevalence of Bunt is indicated by the fact that only 21 out of 129 samples were found to be entirely free. Of the remainder, Bunt was present and visible to the naked eye in 6 samples, and in 102 samples it was found to be present on microscopical examination. Information as to the treatment for Bunt was also collected. As regards analytical purity, the bulk of the samples tested over 97 per cent. Of the 25 samples in which the purity was below 97 per cent., only 3 were below 95 per cent., the actual percentage of these being 94·6 per cent., 93·6 per cent., and 87·6 per cent. Out of 129 samples 104 gave a germination of over 95 per cent.; 14 were between 91 and 95 per cent.; 4 between 86 and 90 per cent.; and 7 were under 85 per cent., the lowest being 67 per cent. Arrangements were made for a further and more comprehensive series of samples to be taken "from the drill" this autumn. It is hoped that an examination of these will permit of more definite conclusions being drawn.

Sugar Beet Seed.—Special attention has been paid to sugar beet seed during the season. All the beet-sugar factories have been visited for the purpose of drawing attention to the fact that when selling seed to farmer growers it is necessary to comply with the requirements of the Seeds Act in having had a test made in accordance with the provisions of the Act and delivering to the purchaser a statement in writing containing the prescribed particulars. These particulars include, *inter alia*, (1) a statement as to the percentage purity if below 97 per cent., and (2) the percentage of germination, provided that if this is not less than the prescribed minimum of 60 per cent. (clusters) a statement to that effect, which must include the authorized minimum percentage, is sufficient. Some 55 control samples of seed were taken at the various factories, and the check tests carried out on these samples at the Official Seed Testing Station showed that in no case was the percentage purity or germination less than the minimum prescribed in the Regulations.

Testing Seeds for Export to the Colonies.—In order to encourage the trade in home-grown agricultural and horticultural seeds exported from this country to overseas parts of the Empire, the Ministry has arranged, with the assistance of a grant from the Empire Marketing Board, that, in cases where the colonial import regulations require that consignments of seeds shipped from this country shall be accompanied by a certificate of test carried out at a British Official Seed Testing Station, such tests may be made for a limited period

at the Cambridge Official Station free of charge. Samples, which should be of the normal quantities sent for testing, must be accompanied by a statement to the effect that the bulks from which the samples are drawn are intended solely for export to a named colony, and that the sender guarantees that the certificate issued by the Official Seed Testing Station in respect of these samples will be used for no other purpose than in connexion with the export of the bulks from which they are drawn to the country specified. Owing to this scheme being put into operation so late in the export season, it was only used to the extent of 453 samples. The scheme is, however, to be continued during the 1927-28 season, when it is anticipated that it will be utilized more freely.

Staining of Imported Seeds.—In the issues of this JOURNAL for August, 1926, and March, 1927, reference was made to the Regulations which are in operation in the United States requiring that all alfalfa and red clover seed or any mixture containing 10 per cent. or more of these seeds imported into the States shall be stained with distinctive colours according to the countries or regions from which they come. Similar import regulations became effective in Canada in October, 1926, more recently in France and, it is understood, are also contemplated by Germany, Sweden, and Czecho-Slovakia. A question was put to the Minister of Agriculture in the House of Commons in March, 1927, as to whether his attention had been drawn to the regulations operating in the United States and Canada requiring imported seeds to be stained distinctive colours, thus signifying their adaptability or otherwise for agricultural purposes, and whether he was prepared to introduce safeguards on similar lines for agriculturists using foreign seeds imported into this country.

The Minister's reply was as follows :—

> "I am aware of the Regulations to which my Hon. Friend refers, requiring the staining of certain kinds of seeds when imported into the United States of America and Canada, but I have received no representations as to the desirability of dealing with seeds imported into this country in a similar manner. At the same time the requirements of the Regulations made under the Seeds Act, of 1920, whereby a statement as to the country of origin must be made in the case of a sale of any of the principal kinds of grass and clover seed, should, in my view, afford a sufficient safeguard for agriculturists against the use of seeds coming from countries where the conditions make them unadaptable for use in this country."

Prosecutions.—The following are brief particulars of the cases in which the Ministry has instituted legal proceedings under the Act during the past season :—

(1) An Exeter firm of seedsmen and agricultural merchants was charged with making a false statement as to the percentage of germination of a consignment of Meadow Fescue seed. The case was heard on August 7, 1926, when the defence was put forward that the bag from which the control sample had been taken consisted of old seed which was sent out owing to the error of an employee. The Bench accepted this explanation, but decided that, as the firm must take the responsibility for the acts of their employees, they would inflict a fine of £2 with £2 2s. 0d. costs.

(2) Proceedings were taken on October 15, 1926, under the Seeds Act and the Wart Disease of Potatoes Order, against a dealer of Bromyard, for making statements which were false in a material particular. The defendant had sold a quantity of seed potatoes as being grown in Scotland whereas it was proved that they came from Cambridgeshire. He had also quoted a false certificate number in connexion with the consignment. He contended that these potatoes were sent by mistake, his man loading them out of a truck at the station instead of out of his yard. The Bench imposed a fine of £3 for the offence under the Wart Disease Order and £2 under the Seeds Act, and ordered payment of special costs amounting to £14 11s. 0d.

(3) A case was taken at Bridgnorth on October 25, 1926, in which a seed potato merchant was charged with having sold a quantity of seed potatoes of mixed varieties with a statement indicating that the variety was true within the meaning of the Seeds Regulations, 1922. The defendant acknowledged that he had bought this seed as being mixed, but took the risk of re-selling them as pure. He was fined the maximum penalty of £5 and £3 3s. 0d. costs.

(4) A Berkshire firm of seed merchants was prosecuted on December 20, 1926, for having furnished a declaration with a consignment of Trifolium seed which was not based on the result of a test made in accordance with the provisions of the Act. The defendants pleaded guilty, and the Bench imposed a fine of £2, stating that they thought the offence was more than a technical one.

(5) On December 23, 1926, a case was heard at Bourne, Lincs, against a local firm of potato growers and farmers for selling as "Evergood" two lots of seed potatoes, the crops from which were found to contain about 20 per cent. of rogues. After a prolonged hearing the cases were eventually dismissed on technical grounds.

(6) Proceedings were taken at Epworth on March 3, 1927, against a local seed potato merchant for making a false statement as to the variety of a quantity of seed potatoes. He purchased them from the grower with the description "Class 2 mixed" and sold them with a written description which indicated that they were pure. The resulting crop was found by the Ministry to include 14 per cent of rogues. Defendant pleaded guilty, and was fined £1 and £2 10s. 0d. costs.

(7) A local firm of corn factors was prosecuted at Evesham on March 8, 1927, for making a false statement as to the variety of a quantity of seed potatoes. The defendants were in this case represented by well-known counsel, and the hearing lasted nearly six hours. The Bench were satisfied that a technical offence had been committed but, owing to extenuating circumstances, dismissed the charge on payment of costs.

(8) Proceedings were taken at Portsmouth on May 12, 1927, against a firm of seed packeters in respect of two charges of

making false statements as to the germination of onion seeds. Convictions were obtained in both cases, and a fine of £3 was imposed for each offence, the money to be paid within two months, or in default 21 days' imprisonment for each offence, to run concurrently. This firm was previously convicted for a similar offence in June, 1923.

(9) A florist and nurseryman of Newport, Monmouth, was fined £1 and £1 1s. 0d. costs on July 18, 1927, for making a false statement as to the percentage of germination of some onion seed.

(10) At Caerphilly, on July 19, 1927, a local firm of general merchants was fined £1 and £1 1s. 0d. costs for wrongly stating the percentage germination and purity of some parsnip seed.

(11) On July 20, 1927, a firm of florists and seedsmen at Pontypridd was charged with failing to deliver the required particulars in the case of a sale of garden seeds in packets, and was fined 15s., the Bench warning defendants that the Act must be obeyed in future.

In addition to the above a number of cases were taken in Scotland for offences against the Seeds Act in connexion with consignments of seed potatoes supplied to English customers.

Amendments of Seeds Regulations.—No amendments have been made in the "Seeds Regulations, 1922," so that, unless some unforeseen circumstance should arise, the Regulations will be the same during the season 1927-28 as those which were in operation last season.

NOTE.—Copies of the Seeds Act, 1920 (price 3d. net); the Seeds (Amendment) Act, 1925 (price 1d. net); and the Seeds Regulations, 1922 (price 3d. net), may be obtained through any bookseller or direct from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2.

* * * * * *

THE CORRECT TIME FOR APPLICATION OF SPRAY FLUIDS

H. R. BRITON-JONES, D.Sc., Ph.D., D.I.C., A.R.C.Sc., and A. H. LEES, M.A.,

Agricultural and Horticultural Research Station, Long Ashton.

IN attempting to control the pests and diseases of fruit trees it has become necessary, as the result of continual research work, to define more and more closely the time of application.

At one time it was considered sufficiently accurate to give such advice as "spray in spring" or "give a winter treatment." Modern work, however, has more and more emphasized the necessity of application at a particular stage of development of the plant. Unfortunately these stages cannot be related sufficiently accurately to the calendar, since one winter differs from another.

Attempts have been made to get over this difficulty by using such phrases as "during the dormant season," "in the semi-dormant stage," "when the buds show green," and so on. This, though certainly an improvement on calendar dates, nevertheless leaves too much to the imagination. In the opinion of the writers, the only satisfactory method lay in the preparation of series of photographs showing various types of fruit trees in the required condition. It is with this idea in mind that the photographs illustrating this paper have been prepared.

It has been found necessary to give certain names to the stages illustrated, but the writers do not wish to maintain that these are the best possible. The stages may be roughly defined as follows :—

Dormant : No sign of bud burst to be seen.

Swelling : The buds show the first sign of movement. The bud scales have separated but no green is showing.

Bursting : The bud has distinctly opened somewhat, and is showing green leaf or flower rudiments.

Burst : A stage in advance of bursting.

Green Flower : A stage in apples and pears where the trusses are showing but no petal colour is evident.

Pre-flowering or Pink : Stages immediately before opening of the flower. Pink stage applies to apples only.

No claim for completeness is advanced, but the attempt has been made to include, for the common fruits, those stages which are most difficult to define. It is, of course, quite possible that the future may prove that other fruits and other stages should be included. In the meantime, the writers would emphasize the desired goal to be attained, namely, that of a clear definition, and acceptance among plant pathologists, of certain stages as most suitable for applying given spray remedies.

The writers are greatly indebted to Messrs. J. C. F. Fryer, R. G. Hatton, R. M. Nattrass, F. R. Petherbridge, Dr. Geo. Pethybridge and Mr. L. N. Staniland for valuable criticism, and to Mr. R. G. Hatton for the use of the negative for Black Currant, Stage III.

STAGE	APPLE
I. Dormant (Fig. 1) ..	Stage at which tar distillate fluids are applied against Aphis eggs, Apple Sucker eggs, Winter Moth eggs (Partial Control) and Brown Rot. Also stage for use of

	caustic soda against Mussel Scale and general cleaning of Lichens, etc.
II. Swelling (Fig. 2) ..	Too late for using tar distillate fluids and 2 per cent. caustic soda washes.
III. Green Flower (Fig. 3)	Contact sprays against Aphis, Apple Sucker. Arsenate sprays against Caterpillar.
IV. Pink Flower (Fig. 4)	Contact sprays against Capsids. First application for Scab Disease. The second spray against Capsids and Scab is given at petal fall. No illustration of this stage is necessary.

STAGE	BLACK CURRANT
I. Dormant (Fig. 5) ..	Suitable for tar distillate fluids against Aphis eggs.
II. Bursting (Fig. 6) ..	Dangerous for tar distillate fluids. Suitable for contact washes against Aphis.
III. Burst (Fig. 7) ..	Stage for lime sulphur 1 : 12, against Big Bud Mite.

STAGE	CHERRY
I. Dormant (Fig. 8) ..	Suitable for tar distillate fluids against Aphis eggs, Blossom Wilt and Brown Rot. Also for Bordeaux and Burgundy against Leaf Curl (Exoascus minor).
II. Swelling (Fig. 9) ..	Too late for tar distillate fluids.
III. Bursting (Fig. 10) ..	Contact sprays against Aphis.

STAGE	GOOSEBERRY
I. Dormant (Fig. 11)..	Tar distillate fluids against Aphis eggs.
II. Swelling (Fig. 12) ..	Dangerous for tar distillate fluids.
III. Bursting (Fig. 13) ..	Too late for tar distillate fluids. Contact washes against Aphis.
IV. Pre-flowering (Fig. 14)	Second spraying of contact washes against Aphis if necessary. First application against the American Gooseberry Mildew.

STAGE	PEACH
I. Dormant (Fig. 15)..	Tar distillate fluids against Aphis and Brown Rot (M. cinerea).
II. Swelling (Fig. 16) ..	Burgundy or Bordeaux for Leaf Curl, immediately before. Late for Leaf Curl sprays. Only partial control of this disease is effected when applied at this stage. Too late for tar distillate fluids.
III. Bursting (Fig. 17) ..	Too late for Leaf Curl. No beneficial effect.

STAGE	PEAR
I. Dormant (Fig. 18)..	Tar distillate fluids for Blossom Wilt and general cleaning of Lichens, etc.
II. Swelling (Fig. 19) ..	Too late for tar distillate fluids. Stage for lime sulphur 1 : 12, against Pear Leaf Blister Mite.
III. Green Flower .. (Fig. 20)	Stage for giving first application of spray against Scab. Second at petal fall, and third three weeks later.

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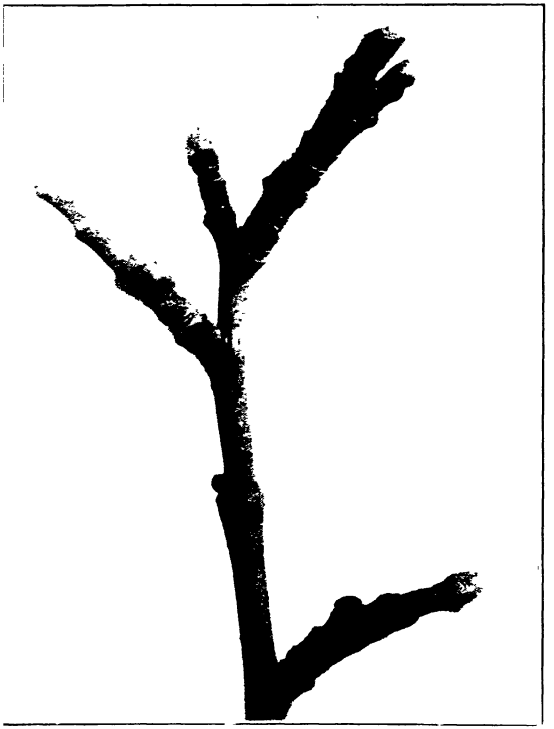

FIG. 1.—Dormant.

FIG. 2.—Swelling.

APPLE

FIG. 3.—Green Flower.

FIG. 4.—Pink Flower.

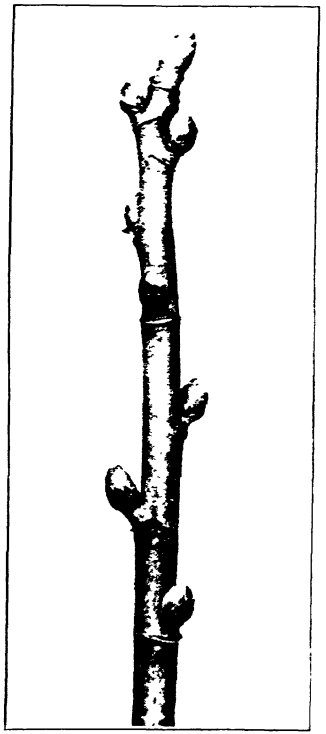

FIG. 5.—Dormant.

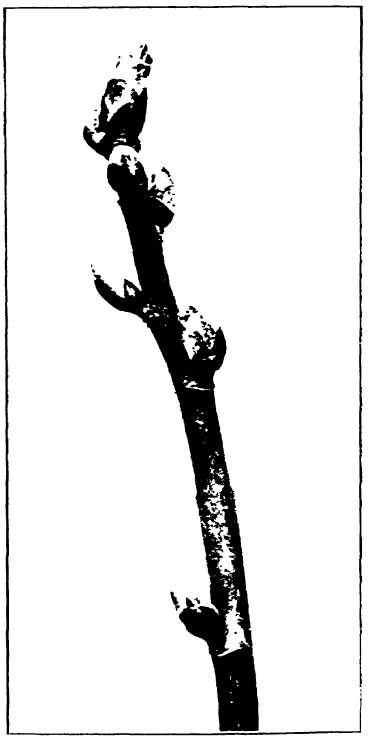

FIG. 6.—Bursting.

FIG. 7.—Burst.

BLACK CURRANT.

FIG. 8.—Dormant.

FIG. 9.—Swelling.

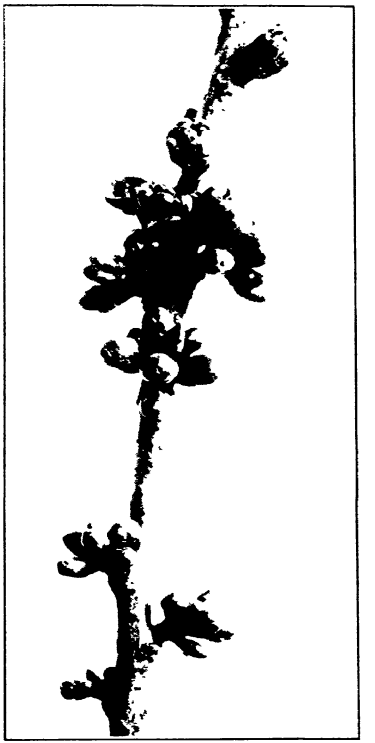

FIG. 10.—Bursting.

CHERRY.

FIG. 11.—Dormant.

FIG. 12.-- Swelling.

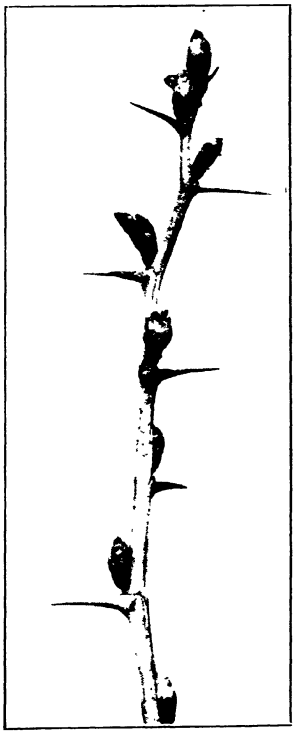

FIG. 13.– Bursting.

FIG. 14.– Pre-flowering.

GOOSEBERRY.

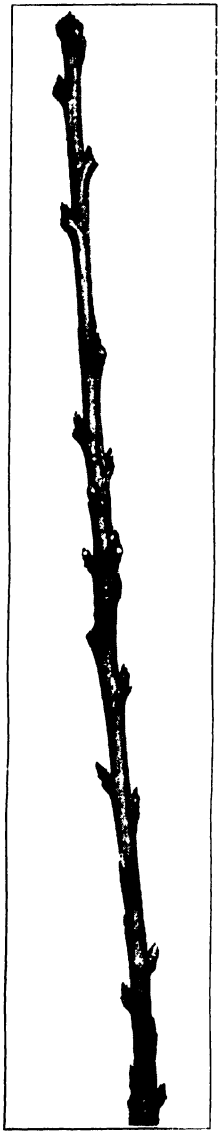

FIG. 15.—Dormant.

FIG. 16.—Swelling.

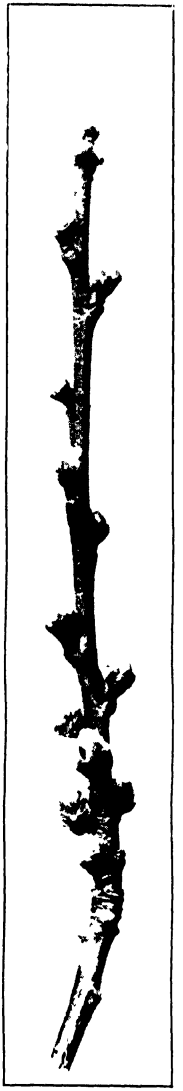

FIG. 17. Bursting.

PEACH.

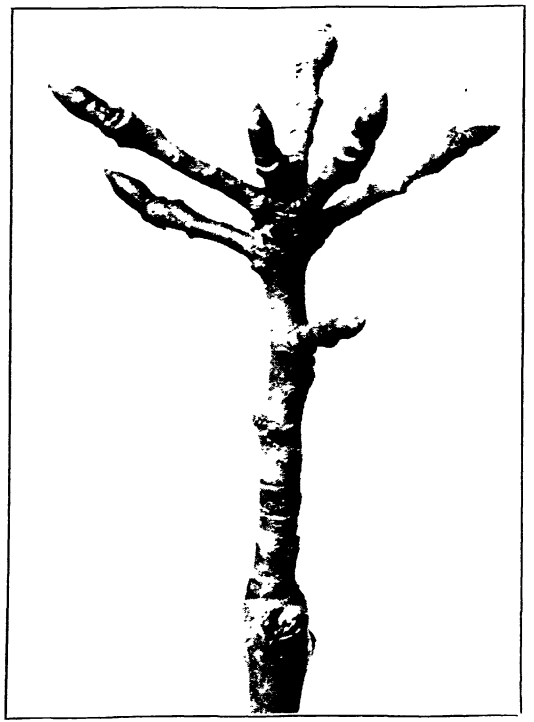

FIG. 18.—Dormant.

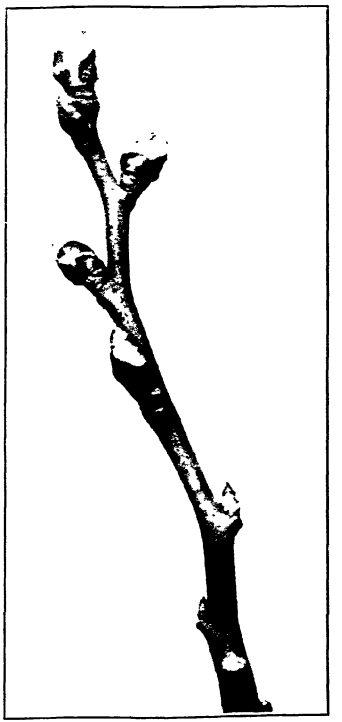

FIG. 19.— Swelling.

FIG. 20.—Green Flower.

PEAR.

FIG. 21.—Dormant.

FIG. 22.—Swelling.

FIG. 23.—Pre-flowering.

PLUM.

STAGE	PLUM
I. Dormant (Fig. 21)..	Tar distillate fluids against Aphis, Winter Moth eggs (Partial Control), and Wither Tip and Brown Rot disease. Also 2 per cent. caustic soda for general cleaning.
II. Swelling (Fig. 22) ..	Too late for tar distillate fluids and 2 per cent. caustic soda wash.
III. Pre-flowering .. (Fig. 23)	Contact sprays against Aphis, and arsenate sprays against Caterpillars.

* * * * * *

THE PROBLEM OF AGRICULTURAL MARKETING*

(1) **Clearing the Air.**—The marketing of agricultural produce is a subject on which there is much confusion of thought and not a little misrepresentation. This is particularly so at the moment because the need for marketing reform has been zealously advocated of late, and, here and there, in the Press and on the platform, extravagant claims have been made and ambitious proposals put forward, which are to be regretted if, for no other reason, than that they raise a cloud of controversy which obscures the main issue. It is desirable, therefore, to clear the air, and I want to start by dissociating the cause of better marketing from two suggestions that have been made: (1) that better marketing is a remedy for agricultural depression, and (2) that it involves the displacement of the existing machinery of distribution.

Better Marketing not a Remedy for Agricultural Depression.—To take the first of these: The present depression, grave though it may be, will, let us hope, pass away as earlier depressions have. It is due mainly to monetary causes of international moment, and no agricultural remedy, as such, can avail. Marketing reform would, it is true, help the agricultural industry and further the work of rescue, but it is to be regarded as a permanent and necessary improvement in business efficiency, of service alike in times of prosperity or of distress.

The Aim to Aid and not Displace the Distributive Machine.—The second suggestion that is made is that the purpose of better marketing is to oust the distributor. This suggestion is a

* Being a note of an address delivered at Kendal on October 8, 1927, by Mr. A. W. Street, the Head of the Markets and Co-operation Branch, Ministry of Agriculture and Fisheries, at a meeting convened jointly by Lord Henry Cavendish-Bentinck, M.P. (Lord-Lieutenant of Westmorland) and the County Branch of the National Farmers' Union.

persistent offender and too often diverts the attention of farmers from proposals which approach the problem by a simpler route and have, at least, the merit of practicability. As I hope to show, better marketing does not mean replacing the existing machinery of distribution by a farmer-owned co-operative system which would probably break down under its own weight, but rather aiding the existing machinery to function to greater advantage, so far as home produce is concerned, than it does to-day.

(2) **Organized Assembling: the Producer's Sphere.**—That is not to say that agricultural co-operation has no part to play in the constructive work that lies ahead. On the contrary, collective marketing in one form or another can, and no doubt will, contribute materially to economic progress. Let us be clear about it. Leaving aside that form of co-operation known as collective bargaining, there are two main fields open to co-operative endeavour in the merchandizing of agricultural produce. There is the co-operative assembling of produce in the areas of surplus production and there is co-operative distribution in consuming centres. The first calls for very serious consideration, if only because of its important possibilities as a means of giving a better service of home-grown supplies to traders engaged in wholesale and retail distribution in the industrial areas; the second, all things considered, is probably best left alone by producers, although some success has been achieved even in this specialized field.

The Case for Co-operative Assembling.—Let us, therefore, examine for a moment the business ideas underlying co-operative assembling. Apart from any theoretical saving in marketing costs arising from the concentration of agencies and functions—and in this highly competitive world of ours the scope for economies can easily be overstated—there is the fact that, in average circumstances, group marketing is, or should be, more efficient than marketing by individual producers, not only in regard to such services as the preparation, classing, grading, packing and dispatch of supplies, but in the search for outlets and in the orderly feeding of markets. Indeed, experience the world over shows that only in exceptional cases can even the large-scale producer, as an individual, market a standard agricultural product continuously and in commercial quantities; as a general rule, the ungraded contributions of individual producers must first be assembled at convenient centres in order to provide the bulk necessary for the grading process and for the maintenance of graded output.

It is suggested that group marketing through a co-operative organization is more efficient than individual marketing. It is not suggested that it is necessarily more efficient, executively, than the usual form of bulk marketing, namely, the assembling by dealers and merchants of supplies bought at farms and country markets and the preparation and dispatch of these supplies to distant consuming centres. Apart from the question of control, it stands to reason that if the co-operative organization and the country dealer render the same services with the same efficiency, then, in practice, both produce the same results, and it could well be argued that no co-operative organization operating in this field has any right to exist, still less to survive, unless it can give service at least as effective as that of the country dealer and no more costly.

Now, in some places and for some commodities, there may be a superfluity of collectors and dealers; that is a debatable question, which must, on the whole, remain a matter of local interest. What cannot be disputed, and what is of national importance, is that the present system of marketing supplies from areas of surplus production—direct consignment by individual producers, or sale to local dealers who buy to send away—too often fails to ensure that home produce shall reach the large consuming centres in a form and condition and in large enough units to compete on equal terms with imported supplies. Something is missing somewhere. Clearly, one way of meeting this situation is for producers to co-operate to render the preliminary marketing services for themselves, to render services that would otherwise be rendered indifferently or not at all—notably those necessary for the marketing of standardized goods and, incidentally, for reflecting back to the producer the real market price for quality. As any one familiar with conditions in country markets knows, the tendency for local buyers to pay a flat price for good and poor stuff alike is traditional and it is still difficult to secure adequate recognition for quality; consequently, high-quality produce subsidizes low-grade supplies, and, for many commodities, there is little or no incentive to raise the quality level of the home-produced article.

The "Export" Argument.—The suggestion is often made, directly or indirectly, that co-operation has only succeeded in countries where dependence on an export trade has supplied the stimulus. As the Agricultural Tribunal of Investigation pointed out, Germany and Belgium are examples of countries that had no such incentive, and yet they have had a progress

in agricultural co-operation as remarkable in their own way as that of Denmark. Indeed, there are many hundreds, probably thousands, of farmers' co-operative organizations in Europe to-day whose outlook is domestic and not foreign, just as the great majority of the 12,000 farmers' co-operative marketing organizations in the United States are solely concerned with the internal trade of that country. In any case, we must remember that those areas of England and Wales where production exceeds local requirements are, in essence, exporting areas, and regularly send their supplies over distances as long as, and in some cases longer than, those over which supplies travel that are received from Northern Ireland, the Irish Free State, France, Belgium, Holland and Denmark, all of which enjoy relative propinquity to our markets here. It may surprise many to learn that Denmark is nearer than parts of Cornwall to such an important consuming centre as Newcastle-on-Tyne.

The Alternative.—I do not, however, plead for collective marketing by producers. It is a means to an end ; it is not the only means ; and, however desirable it may be, one would not hold it to be essential to the far-reaching reforms in marketing which I am sanguine enough to believe that this generation will see. It is merely desirable to point out the quite definite part that agricultural co-operation could play in the standardization of supplies for "export" from the surplus-producing areas of England and Wales, and to show how it could and should be an aid and not a rival to the distributive trade in the towns and cities, including, of course, the consumers' co-operative movement. At the same time, it should be realized that in many exporting countries organized assembling and the standardization of product and package are not, in fact, done by co-operative associations, but by merchants and exporters. Even in Denmark, although it is true that about 85 per cent. of the bacon exports are from co-operative bacon factories, it is also true that only about 20 per cent. of the total egg export trade and under 40 per cent. of the butter exports are handled by co-operative associations. The practical point is that the English wholesale market demands products of guaranteed quality, and, for most commodities, some form of organized assembling is an economic necessity if this demand is to be met. If, therefore, for any reason, whether of psychology or environment, home producers are not disposed to co-operate to do the things that, under present arrangements, are too often left undone, then, as an alternative, it is up to them to encourage and support any business enterprises that under-

take to handle home produce on up-to-date lines and place it in the hands of distributors in a form which accords with commercial requirements. It is the function that is important in this connexion, and, from a common-sense business standpoint, producers cannot escape the responsibility for seeing that the function is performed.

(3) **Standardization : the Main Issue.**—The importance of feeding the distributive machine with goods that conform to modern commercial requirements has been emphasized. These requirements can be summed up in the word already used, namely, *standardization*, which has been described as the first principle of modern commerce, the movement from the indefinite to the definite. It is not too much to say that the greatest problem which confronts the British farmer in the marketing field is that of devising a workable system for the standardization of his products.

What it Means.—The coinage is standardized ; weights and measures are standardized ; everyone knows what standardization means in these instances, and how clumsy and hopeless business would be without standard money or standard quantities. The general standardization of agricultural commodities has much the same significance and would serve a similar purpose. In fact, the reasons for fixing standards of money and quantity are precisely the same as those for defining general standards of quality for an agricultural product, attaching these standards to fixed characteristics such as size or weight in order to arrive at a uniform classification, and for extending the principle, where applicable, to packing and packages.

Relation to Production.—If standard goods are to be marketed, they must either be produced to standard or they must be graded into standard categories. In industries other than agriculture, it is relatively easy, thanks to mechanical processes, to deliver articles complying with exact requirements. In agriculture, Nature often opposes or changes the course of the most judicious measures or precautions and the task is much more difficult. An aggravating circumstance is that production, instead of taking place at one centre and under one direction, takes place on a multitude of independent holdings. Hence, for the marketing of standard farm products, a standard grading system is essential. It is possible, however, for producers of some commodities—*e.g.*, cattle, bacon pigs, table poultry or fruit—to simplify marketing and reduce the extent and cost of the grading service by standardizing their production

types. The fact that this is an obvious and first step towards better and cheaper marketing, and one of great importance to home producers in present circumstances, is gradually gaining recognition.

Consider beef cattle for a moment. Our overseas competitors have entrenched themselves in the large wholesale markets by supplying carcasses that are carefully graded to weight and quality at the source. The retailer can go to the meat market from day to day with the reasonable certainty of being able to purchase overseas carcasses that will yield joints of the size and quality that his customers have learned to expect. He can even rely on sending a written order without visiting the market at all. He has only to make allowance for necessary seasonal differences. It is obviously impossible for our farmers to reach a similar degree of standardization except by breeding to type. We are a comparatively small country, agriculturally, and we have many breeds, each with its own characteristics. The great variety of type and breed can be clearly seen in any live-stock market. That, however, does not mean that we should give up the ideal of levelling up our live stock, so that a standard article is available for the big consuming centres. One would not suggest that all farmers should concentrate, for instance, on one breed of cattle. We have many excellent breeds, which are, in general, most successful in their own area. If we wish to make the most of the commercial cattle of each breed, we need to ascertain as closely as possible the demand of the buyers, and then endeavour to bring those cattle up to that standard throughout the whole district in which the breed is found. Only then shall we be able to meet the demand of the large buyers for an ample supply of a standardized article. We have also to consider that, in the case of all live stock, the butchers' demands are changing because the demand of the public is changing. During the last 20 years, the change has been in the direction of smaller joints and a greater proportion of lean meat. This is too extensive a subject to go into here —but there is nothing more vital to the economic prosperity of the British breeder and feeder than that his live stock should conform to the changed demand which many circumstances have combined to bring about.

The reaction of a standardization policy on production is, of course, of supreme importance. The recognition of quality which such a policy implies definitely encourages the production of quality goods. It has recently been stated, for example, that it is now possible to attribute 90 per cent. of Denmark's

continued success on the English market to better production and that only 10 per cent. is attributable to better marketing, although better marketing was the cause that produced the effect. A standardization policy in this country would, therefore, help the home producer to concentrate on the quality end of the market. Certainly, if standardization raised the average quality of the home output so that a larger proportion than at present were of first quality and commanded first-quality prices, a notable contribution would be made to the economic well-being of the industry.

Commercial Advantages of Standardization.—Standardized grading increases the speed with which business can be conducted. It provides a basis for a system of selling in which inspection need not invariably precede purchase; it makes possible the accurate determination of values and the quotation of comparable market prices; it reduces buyers' risks, minimizes disputes, encourages long-period contracts between sellers and buyers, widens the market all round and, in general, facilitates sale from assembling points in producing areas to distributors in consuming centres. It facilitates credit accommodation and, in particular, the financing of such operations as storage. The standardization of containers is also of considerable importance in this connexion. It is obvious that, if one or two types of packages be selected as best adapted to trade requirements and these types alone are manufactured, not only are cheaper packages possible but, with standard methods of packing, the quantity element is standardized. Thus standardization means increased business efficiency and a corresponding reduction in marketing costs; it has also important reactions on consumer-demand to which reference will be made later.

Because of its superior economy, the standardization of grades (and, where applicable, of containers) is an inevitable reform, just as the general standardization of gauge for all main lines of railway was inevitable from the start. It is true that it may be more difficult to work out acceptable standards for some agricultural commodities than for others, but the difficulties will gradually be overcome with the evolution of improved marketing technique. It remains to be added that the commercial advantages of standardization are important enough in regard to a commodity like potatoes, of which British farmers supply over 90 per cent. of the country's requirements, but they are of overwhelming importance in regard to those home-produced commodities which have to

face the competition of imported supplies. To appreciate this latter fact, let us examine the trend towards standardization in other countries.

The Trend Abroad.—At the recent World Economic Conference at Geneva, the standardization of agricultural products was recommended in the interests both of producers and consumers. Certainly, standard classification and grading are becoming increasingly necessary in international trade. In most exporting countries, minimum quality standards are prescribed which supplies must attain before export is permitted; such supplies, in practice, enjoy a privileged position on the world market. A glance at some of the recent developments is instructive. The Dominions have made important progress since the war in the standardization of commodities for export trade—notably, dairy produce, eggs, meat, and fruit. The grading of New Zealand carcasses of mutton and lamb is a classical example of standardization in regard to type, weight, and finish. Rapid strides have also been made, as regards dairy produce, by European countries—Holland, Denmark, Sweden, Norway, Latvia, Estonia, and Finland. The definition of standard grades for eggs has been taken in hand by most Baltic countries since the war, and also by Northern Ireland and the Irish Free State. The standardization of Danish bacon supplies is common knowledge. In Holland, the quality, packing, net count, and weight of fruit and vegetables exported have been subject to a scheme of control for the past three years. In March of this year, Italy passed legislation designed to give the buyer of Italian fruit and vegetables a guarantee of quality and so to improve the value of Italian products on foreign markets. It is understood that Northern Ireland is contemplating the introduction of a standard grading system for potatoes and dairy produce in the near future, and that Canada will shortly promulgate national grades for dressed poultry. This shows the trend clearly enough; it also shows the startling rapidity with which developments are taking place in countries immediately concerned with our market here. This, however, is not the whole story.

The "Export" Argument Again.—Even more striking are developments in the United States, where standard grades are fast being worked out and announced by the Federal Department of Agriculture. Grades to fit commercial conditions have now been established for over three-quarters of the agricultural products of the Union, including 35 different kinds of fruit and vegetables. A notable advance last year was the

formulation of grades for live stock, beef carcasses, and wool. The important point regarding this work in the United States is that it is emphatically not inspired solely by considerations of export business, since many, if not most, of the commodities concerned do not move beyond the home market and are being standardized in the interests of economy and for the simplification of business dealing. Then, again, standard grading systems are operative in Canada for potatoes and eggs, for example, yet these commodities are mainly produced for the Canadian market.. Clearly, we cannot dismiss standardization with a wave of the hand as being a peculiar requirement of export trade.

Let us pursue this a little further. In Germany, the competition of dairy produce of guaranteed quality from Holland, Denmark and the Baltic countries has been increasing in severity. This has produced a situation there very similar to that here, in that German produce is challenged in its own markets by an influx of standardized goods from abroad. It is admittedly more difficult for an importing country to adopt a standardization policy than it is for an exporting country to do so, but the German dairy-farmer has decided that the difficulties have, somehow, to be overcome if his goods are to hold their own against foreign competition, and he is displaying great activity. A little over two years ago, organized farmers in the province of Schleswig-Holstein made the first move, and instituted a butter-control on Danish lines ; about the same time, the Rhenish Provinces blazed the trail for the cheese-makers. Since then one dairying province after another has followed suit and development is still proceeding. The standardization and uniform packing of dairy produce, and its classification according to type, are now the declared objectives of the German Government. There is reason to think that, in the not too distant future, Germany will take up the question of the standardization of agricultural products in general.

Home Produce Must be Standardized.—Every thoughtful man must recognize the urgent necessity for standardizing the grading of home produce as far as may be practicable. There are three reasons for deliberately resorting to such a policy. One reason is that, as already indicated, it means more economical marketing. Another is that ungraded, nondescript supplies, or supplies graded in a multitude of different ways, cannot make the same appeal to the distributive trades, and especially to the wholesale distributor, as standardized imported goods that can be handled in bulk and meet require-

ments in every detail; the distributor is in the business for his living, and he is not interested in home production for home production's sake. The third reason is that some clear-cut method is necessary by which superior home-grown produce may be definitely distinguished from that proportion of home produce—small though it may be—which is of low quality and acts as a drag on the market for home produce in general. Exporting countries keep their low-grade supplies at home and only send us their best. The least that we can do is to see that our best is distinguished from our worst, and that good and bad alike are not marketed under the same designation.

Taking a broad view, we may disregard direct sales from producer to consumer, or even, for that matter, from producer to retailer. Direct trade on these lines is, of course, considerable, but it is a limited trade and has but limited potentiality compared with the enormous demand of the wholesale distributive machine. Where standardization is clearly desirable, at any rate as a first step, is in regard to supplies of home produce that are surplus to local requirements and rely on the wholesale distributor for a market. There is valuable ground to be won back for the British producer in this way. It is to be remembered, too, that if, through standardization, the demand for home produce can be improved in the large consuming centres, the benefit will be felt away back in the remotest village.

Hopeful Signs.—The first steps have already been taken. The British Glasshouse Produce Marketing Association has been working since 1922 a standardization scheme, which provides for standard grades and packages and a registered trade-mark. This year, producers of Cheshire and Cheddar cheese have, respectively, formed federations for the purpose of controlling the quality of their products by means of trade-marks and a qualifying standard. For fruit, a number of commercial grading and packing stations are springing up, most of them being private businesses, there being as yet but little tendency among producers to co-operate for this purpose. One or two large-scale conditioning, grading and packing plants for poultry have recently been established, and also one or two packing stations where eggs are graded to standards and packed in standard non-returnables; here, again, the development is mainly non-co-operative, but, from the standpoint of better marketing, most sound and promising. Then there are those co-operative organizations for the classing, bulking and central sale of Wool—Kent Wool Growers, Southdown Wool Growers

and Eastern Wool Growers. A start has been made; how can we accelerate progress in order to meet the needs of the situation without undue delay?

(4) **The Line of Advance.**—Those countries that have introduced measures of compulsory standardization are usually exporting countries, and the regulations, in many cases, only apply to exported goods. In Canada, as already stated, the standard grading of eggs and potatoes is, however, obligatory even in domestic trade. In the United States, the policy followed is to promulgate grades which experience shows to be feasible, and to do all that is possible on a voluntary basis to work them into the trade; compulsory grading to standards is only, I think, applied by Federal law to grain and cotton, and, in these cases, compulsion was demanded by all interests concerned. For other commodities, the standards are, at the moment, permissive or tentative, supported in the former case by an inspection service. Compulsory grading laws have, it is true, been passed by several States of the Union, but the great majority of producers came into line beforehand and the legislation was only aimed at a small but irritating minority. Although the adoption of permissive standards is being extended mainly by educational means, progress has been extremely rapid for many commodities. Already 85 per cent. of the commercial potato crop, for example, is voluntarily sold under the Federal grades.

The system adopted in the United States has much to recommend it. Certainly, mandatory legislation is to be avoided if other means can be found. It should be remembered, however, that, in the United States, the domestic market is not invaded to any great extent by standardized goods from abroad, and there is thus no question of *force majeure*. As far as this country is concerned, if we are to continue on the present voluntary basis, the best line of advance would seem to be (1) for the Ministry of Agriculture, after due inquiry, to suggest standards which, in the light of trade experience, are regarded as suitable, and (2) for some special incentive to be devised which will encourage their rapid adoption in view of the quality pressure of imported supplies.

A National Mark.—With regard to (1), the Ministry of Agriculture has recently suggested standard grades for a number of commodities and demonstrated them publicly; others will be suggested and demonstrated as investigations proceed. As regards (2), a national quality mark, duly safeguarded against misuse, might well supply the special incentive desired.

A national quality mark is a familiar enough device in international trade. We may take the export butter market as an illustration. There is, for example, the "Kangaroo" mark of Australia, the "Fern" mark of New Zealand, the "Lur" mark of Denmark, the "Rune" mark of Sweden. Among other countries employing national butter marks are Holland, Norway, Finland, Latvia, Estonia and Lithuania. In order to bring in an impartial authority standing outside the actual trade, and in the interests of publicity, such marks are usually the property of the Government concerned; their use is only authorized on goods, or packages containing such goods, that reach a prescribed standard of quality and comply with certain conditions as to packing, etc. The marks are regarded as national trading assets and are guarded most carefully by strict inspection. They are a valuable auxiliary to quality control. In each case, they have been resorted to in order to gain improved access to the English wholesale market. Cannot we use the same device in order to improve the demand for our own goods on our own market? Cannot we, too, fly our flag and use a mark which is at once an indication that the goods to which it is applied are of English origin and of guaranteed and defined quality? The mark here shown, which is the property of the Ministry and cannot, of course, be used without the Ministry's permission, is put forward to illustrate the principle; it is designed to be effective in retail and semi-wholesale as well as in wholesale trade.

In any scheme involving the employment of a national mark for English produce, it would probably be necessary to register individuals who were authorized to use the mark, to arrange for the sampling and inspection of consignments and for the withdrawal from an individual of the right to employ the mark in the event of non-compliance with the conditions laid down. Nevertheless, the use of the mark would remain entirely voluntary and only those who wished to take advantage of it would be subject to the measures necessary to ensure that the mark was really a guarantee of quality and reliability. For convenience of administration, it may prove desirable to delegate responsibility for controlling the use of the mark to area associations of producers and others concerned. Certainly, each commodity would require a separate organization for this purpose. Further, it would be essential from the start to secure the active co-operation of the distributive trades in the towns and cities. It should be added that the national mark need not displace any existing mark; for

EMPIRE BUYING
BEGINS
AT HOME
PRODUCE OF
ENGLAND & WALES
NATIONAL MARK
— (REGISTRATION APPLIED FOR)
Malby & Sons

example, it could be used concurrently with the private marks of commercial fruit-growers, or the marks recently registered by producers of Cheshire and Cheddar cheese, provided always that the goods conform to the standards laid down by authority. These are, however, matters of detail. The essential point is that, under safeguards to be devised, the national mark could be used, in some form, as a label, stencil, stamp or tab, on most kinds of agricultural produce, or on the containers, as convenient. It could be applied, for example, to packets of beet sugar and flour, to egg cartons, to fruit boxes and to potato sacks. There may be difficulties, but it is perhaps not impossible to devise a workable scheme by which wrapping-paper, bearing the national mark, would be usable for English meat and poultry of standard quality. In this way, one home-grown product would advertise and support another, and all users of the mark, whatever the commodity with which they may, as individuals, be concerned, would be vitally interested in protecting it from abuse and in preserving its reputation.

National Advertising.—In the same way, all authorized users of the mark would be interested in securing for it the widest publicity and could create a common fund for that purpose. From the standpoint of the industry as a whole, this would be more effective and economical than an arrangement by which producers of this commodity or that contribute to "Eat More ———" campaigns that may be successful in some degree, but are liable to be mutually destructive, since the human stomach cannot be stretched indefinitely. In any event, except for commodities like fresh milk, that are wholly produced at home, such campaigns are likely to benefit imported supplies to an equal if not greater extent than home-grown.

Then again, one hears much of the efforts of the Empire Marketing Board to foster Empire trade, and sympathizes greatly with them. The Board has laid down, and it has been accepted without demur, that the home consumer should be encouraged to select home produce first, Dominion and Colonial produce second, and to buy foreign produce only if there is no Imperial alternative. The efforts of the Board are to be sustained over a period of years. Clearly, there is here a great and unprecedented opportunity for the home producer. But just as it is useless for the Empire Marketing Board to expect the housewife to buy Dominion produce unless it compares favourably with foreign produce in price and quality, so is it equally necessary that home produce be worthy of the first place and able to maintain it. Under existing conditions,

however, the would-be consumer of home produce has two difficulties to face : (1) the lack of effective means of identification, and (2) the fact that there is frequently no assurance of finding the same thing twice. Everyone knows that when English produce is good it is the best in the world ; where, for example, can the finest English beef or the English new-laid egg be rivalled ? The trouble is that, in the nature of things, there must always be a certain amount of home-grown produce which is of poor quality, and that, at present, this often masquerades under the name of the best to the prejudice of the reputation of home produce as a whole. When the housewife buys home-grown produce in the belief that she is buying the best, and she gets cow-beef or incubator eggs, she naturally says, " If this is home-grown, then I shall buy imported next time." It is here that the national mark comes in. The national mark would stand specifically for quality and for quality only ; it would also stand for continuity of quality and, above all, it would stand for England and Wales.

Let us consider, in this connexion, the advertising campaign in support of Empire produce which the Empire Marketing Board is carrying out in the Press and by means of posters. The Board is doing its utmost in this campaign to keep home produce to the fore in a general way, and there is no doubt that good is being done, but how much more downright good would result if the Board could focus its activities, as far as home produce is concerned, on a national mark which could be advertised on the hoardings and in other ways, which could be the emblem of home produce in general and, by its implications in the matter of quality, not only divert demand from foreign goods, but create an ever-expanding demand for home products ?

It should be remembered that it is an essential part of the plan that the national mark should be applied, where possible, to retail packages, such as cartons, packets, etc., as well as to wholesale containers, and so carry its message into the very homes of the people. What better means could be devised of winning for the farmer the sympathy of the large industrial population of this country ?

Then there is the participation of home produce in the displays of Empire produce which are staged, from time to time, under the ægis of the Empire Marketing Board at trade and other exhibitions. One needs to be associated with the staging of these public displays to form an idea of the advance that would be made if such a thing as a national mark were in

existence for home produce, around which could be weaved a story that would make a new and effective appeal both to the distributor and to the consumer.

In this connexion, it is important to realize that Orders under the Merchandise Marks Act, requiring the stamping of imported goods, would not in the least diminish the necessity for building up the goodwill of home produce in the large consuming centres, by means of a standardization policy expressed through a national mark. On the contrary, although such Orders might make the results more effective, they would equally render the policy more urgent and necessary.

The Consumer's Position.—Finally, let us consider briefly the likely reaction of the consumer to a standardization policy applied to home-produced supplies. Canada can teach us something here. About five years ago, Canada introduced legislation for the compulsory grading of eggs in both domestic and export trade. For the previous twenty years, the estimated *per capita* consumption of eggs in the Dominion had been static, although it was greater than the consumption in this country. Since the advent of standardization, the *per capita* consumption has nearly doubled, so that practically two eggs are eaten now where one was before. This shows how the consumer reacts to dependable quality. It shows also that, fundamentally, the question is one of confidence. If, therefore, home products can be standardized as far as possible, then the normal appeal of standard products may be expected to bring an all-round improvement in demand for home produce. If, in addition, the preference of the consumer for home-produced supplies can be mobilized—a preference which, in the absence of a national mark and quality guarantee, has never been given half a chance—there is no reason why standardized home products should not gradually regain the ground lost to foreign supplies of competitive quality so far as the seasonality of production will allow. This way lies security for the progressive expansion of the industry.

(5) **Conclusion.**—I have presented the case for better marketing; suggestions for your consideration are now before you. They are only suggestions, just as the whole of the Ministry's marketing work—the Economic Series of marketing reports, the marketing demonstrations and so on—is intended to be suggestive. It is hoped, however, that in them the outlines of a marketing policy may be found.

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COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-fifth meeting of the Council was held at the Middlesex Guildhall, Westminster, on Thursday, October 20, 1927: Mr. W. R. Smith in the Chair. The CHAIRMAN, on behalf of the Council, welcomed to the meeting Sir Charles Howell Thomas, the new Permanent Secretary of the Ministry of Agriculture, succeeding Sir Francis Floud.

Statement by the Minister.—The Rt. Hon. WALTER GUINNESS, in the course of his address to the Council, said that it was meeting under very depressing and difficult conditions. The early promise of a good harvest had been spoilt by bad weather, and now, although it was too early to judge finally as to results, he was afraid that the condition and quality of the crops would leave a good deal to be desired. As regards quantities, the estimates of the barley and oat yields were above average, and wheat slightly below average. He hoped that sugar beet, at least in the eastern part of England, might do something to mitigate the general bad record. There were now 229,000 acres under sugar beet; four new factories were opening this month, and five of those working last year would have their capacities greatly increased for this season; there were six schemes for new factories under consideration.

Taking the year as a whole, there had been much greater freedom from Foot-and-Mouth Disease. In the first nine months there had been 33 outbreaks as against 183 outbreaks in the same period of 1926. This month there had been nine outbreaks, eight of which were in Somerset and all connected. The disease had spread in Somerset through the failure of farmers to report as soon as their animals showed symptoms of trouble, and the cause had been discovered by the patrolling of the Ministry's Inspectors. Experience had shown that if only immediate notice of disease was given the outbreaks could be stamped out in their initial stages. The outbreaks were especially unfortunate from the point of view of the export of pedigree stock. The provision of quarantine stations was, however, being pressed forward, so that export of such stock could take place under certain conditions, even though outbreaks were occurring in the country. It was hoped that the first station, that in London, in the erection and preparation of which the Empire Marketing Board had helped, would be opened early next year.

The Minister emphasized the importance of the work of the Imperial Agricultural Research Conference, and referred to

recent advances which had been brought about through research in agriculture all over the world. Marquis Wheat in Canada, Yeoman Wheats in this country, and the increase in supply and cheapening of price of practically all artificial manures were obvious examples. Last month, the price of nitrogenous manures was only 3 per cent. above the pre-war figure. The Minister said that the most hopeful factor of all was that agricultural research and education were being widely appreciated by farmers, and that already a generation had been produced which was willing to look to science for help and guidance in its difficulties. He then informed the Council of the action taken by the Government in connexion with a resolution passed at their last meeting, in suspending the 33⅓ per cent. duty on the importation of synthetic urea until next March so as to enable agriculturists to obtain supplies pending the production of the article in this country.

Turning to the work under the new Small Holdings Act, the Minister stated that 29 counties had sent in 55 schemes involving a charge on the rates and a consequent contribution from the Exchequer. He thought it was satisfactory that so many counties had been found ready to take advantage of the opportunities under the Act and to bear their share of the cost involved. The CHAIRMAN thanked the Minister, on behalf of the Council, for the address.

Improvement of Marketing of Agricultural Produce.—The Rt. Hon. Sir FRANCIS ACLAND, Chairman of the Standing Committee, presented a preliminary report for the Council's consideration, as follows :—

STANDING COMMITTEE'S PRELIMINARY SUGGESTIONS ON THE SUBJECT OF THE IMPROVEMENT OF MARKETING OF AGRICULTURAL PRODUCE

(1) That it is of urgent importance that the agricultural industry should consider the better marketing of agricultural produce in the light of the material now available, with a view to securing for the producer greater control over his product than he has at present.

(2) That among the primary objects to be aimed at are closer touch with the consumer and better standardization both in the quality and quantity of supplies ; and that the services which might be rendered in these ways would entitle the producer to receive a larger share of the price which the consumer pays.

(3) That, though the assistance of the State would be necessary in setting up the marketing organization and machinery required for different classes of products, the movement must be primarily that of the producers, success being impossible without a guarantee of supplies.

(4) That, in order that producers should be willing to undertake the responsibility for initiating, setting up and seeing through new marketing systems, they must be certain in advance that the profits accruing shall be secured to the industry.

(5) That the question of benefiting the agricultural community by placing the purchase of wheat and meat, whether home-produced or imported, under national control deserves careful consideration.

(6) That the Council of Agriculture for England may take a useful part in the movement for better marketing by preparing a report covering the scope of the above resolutions, and indicating the practical steps which would be required, and that, to this end, the Standing Committee be instructed to act as they may think best, with a view to presenting a draft report at the next meeting of the Council.

Sir Francis, after explaining the report, said the Committee did not ask the Council to adopt it unless it desired to take up the question of marketing seriously.

Brig.-Gen. H. CLIFTON BROWN, M.P. (West Sussex), said that the Standing Committee, in their inquiries, might consider what wider conditions should be attached to the present regulations governing loans to co-operative enterprises. A Society should be able to obtain loans for such purposes as manufacturing feeding stuffs for the use of its own members. The point had cropped up in connexion with a certain co-operative society which milled a "balanced ration" recommended by the Reading Dairying Institute. The ration was made up of home-grown cereals, plus 10 or 15 per cent. of maize. The Ministry of Agriculture was unable under its regulations to make a loan to assist the society. The MINISTER replied that he feared it was not possible for State money to be used to subsidize the farmer in competing with the manufacturing industry. If such an application were granted it would be difficult to know where to stop in subsidizing those who worked up the produce of British farms.

Mr. ROBERT HOBBS asked whether transport was meant to be considered under the terms of the report. Sir FRANCIS ACLAND replied that it would be considered. Mr. GEORGE DALLAS spoke in favour of the adoption of the report, stressing the importance to the industry of stability of prices. Mr. H. C. GARDNER (Worcester) considered that it was wrong to say that there were too many men between the producer and the consumer, and that they swallowed up the profits. There were no more between the farmer and consumer than between the manufacturer and the retailer of goods. On the question of transport, not only were railway charges higher, but the service was poorer than before the war. Dr. CROWTHER said he was firmly persuaded of the necessity for the grading and standardization of goods before they reached the consumer. He was not, however, persuaded that it was the producer's business to do that grading. The majority of producers were probably not competent to grade to the degree that is essential

for proper marketing. He also found, as a producer, that for one particular article, namely, eggs, it was quite unprofitable for him to undertake their grading and standardization. On the general question of co-operative marketing, however, he felt very strongly that it was far and away the most important issue that British agriculture had to solve at the moment.

Mr. H. DENT BROCKLEHURST (Glos.) said that the two co-operative fruit markets in Gloucester experienced the greatest difficulty in collecting the produce of the small grower. Organized collection and transport was a prime necessity in their case. Mr. A. MATTHEWS (Hereford) said that, short of a system of supply direct from the producer to the consumer, the mere putting goods on the market in a different way was not going to improve matters.

Mr. GEORGE HEWITT said that co-operation amongst farmers was essential. A farmer invited to co-operate was sometimes found to be butcher as well as farmer, and to prefer to make a sacrifice on his farming business and get it back on butchering. Such a man was likely to stand out from any co-operative scheme. Co-operative organizations were also up against private trusts who were willing to lose, sometimes, thousands of pounds if they could undersell or over-buy the co-operators.

Lord BLEDISLOE, Parliamentary Secretary to the Ministry, said that the Ministry welcomed this report, and hoped the Council would adopt it, but with a caveat in respect of paragraph 5. The Ministry doubted whether such a scheme as there referred to could be in the best interests either of producers or consumers. He was glad to hear that transport was to be considered, as the charges for produce, which had to be paid for at the higher rates, were higher than in any other important country in the world. This country was the most attractive food market in the world, and, by co-operation or otherwise, our farmers should aim at getting as large a proportion as possible of the home trade. The Marketing Branch of the Ministry, which was being materially assisted by the Empire Marketing Board, was working hard at the problem: demonstrations on better marketing were being given at agricultural shows and were proving of value. He thought, with Sir Francis Acland, however, that the movement was primarily a producers' movement.

In reply to the discussion, Sir FRANCIS ACLAND agreed that at present individual efforts to grade and standardize produce did not always pay for the work involved; that would be so as long as they were merely individual efforts. It did not

in the least prove that all individuals would not get a better price when they graded in the same way. The report was adopted unanimously.

Electricity Development in Rural Areas.—In the absence of Sir Douglas Newton, M.P., Sir FRANCIS ACLAND moved the following resolution :—

> That the Council request the Standing Committee to consider the question of electrical development in rural areas, and to examine the reasons and difficulties which have retarded the supply of electricity in England as compared with Continental countries, and to report as to the best methods of overcoming them; also to advise as to the nature of the representations which should be made to the Government for the provision of facilities to encourage the distribution of current in this country in a similar manner to distribution on the Continent.

Mr. DENTON WOODHEAD seconded. The MINISTER OF AGRICULTURE said he welcomed the suggestion that the Council should take up this subject. The Ministry had already given much consideration to it and had rather come to the conclusion that what was necessary was a general survey of the position and not a technical inquiry. Foresight in the planning of the " grid " would, however, have a lasting effect on the possibilities of a cheap supply to rural areas. The Ministry was having inter-Departmental discussions with the Electricity Commissioners and the Ministry of Transport on the subject. Mr. WEARMOUTH (Durham) said he had had electricity on his 300-acre farm for about 14 years; all his grinding and mixing of food, all stacking of corn, thrashing, etc., was done by electricity. At the present time the cost of equipment would probably be too expensive for most farmers, and it might be possible to help under a short-term credits scheme.

The resolution was put to the meeting and carried unanimously.

Holidays for Agricultural Workers.—Mr. JOHN BEARD moved the following resolution :—

> That the Council of Agriculture for England recommends that, in view of the difficulties of including the agricultural workers within the provisions of the Unemployment Insurance Acts, a Committee be appointed to examine the possibilities of setting up a scheme whereby agricultural workers shall be assured of two weeks' holiday per annum with pay: the funds for such a scheme to be raised by
>
> (*a*) Contribution from the workers;
> (*b*) Contribution from the employers;
> (*c*) Contribution from the Government;
>
> and the Committee also to examine if and how it is possible for the administration of such a scheme to be placed under the control of the Agricultural Wages Board.

Mr. BEARD said that the problem was not so much that the agricultural labourer was unemployed as that he was over-employed. Four million pounds per annum would probably be the State's share in the cost of the scheme. Conditions were different formerly, for when a man left his place at the end of his hiring year he had five or six days' holiday paid for, which he would take before he started on a fresh job. That was gone, and there was nothing to take its place.

Mr. DALLAS seconded the resolution.

Lord BLEDISLOE said that the Government would be unable to accept the resolution if it were passed. He had every sympathy with the agricultural worker, but he could not agree that he was over-employed. There appeared to be no logical connexion between unemployment insurance and holidays, and any scheme for holidays, certainly in the present financial stringency, must be left to the industry itself. In any case, the workers in other industries and their employers would naturally take strong exception to being taxed for such a purpose as was suggested. Mr. BRUFORD (Somerset) objected to the proposal on several grounds, particularly on that of the farmer's financial position. His own men got a holiday when they wanted it; not a fortnight's holiday, but a day here and there as they asked for it. Mr. BEARD, in reply, said that the workers had had no opportunity to show whether they would or would not appreciate a fortnight's holiday. He thought they would appreciate it, and, like other people, wish to get to a seaside resort, or to London, or elsewhere. The motion was put to the meeting and lost.

Agricultural Rating. — The Rt. Hon. Lord STRACHIE moved :—

> That this Council requests the Government to increase the grant under the Agricultural Rates Act, so that agricultural land may be relieved from all local rates.

Lord STRACHIE moved this amendment on the ground that farming land constituted the raw material of the farmer and should not be taxed. He did not think that the additional relief would cost more than 3½ or 4 million pounds. In giving such a grant, the Government would assist not only agriculturists but those who owned houses and other property in rural areas, and who had to help in making up the deficit through the grant under the Act of 1896. In his own area the effect of the grant would be that the local rates would be reduced by 2s. 9d. in the £. He did not think that farmers

could expect their buildings and farms to be entirely free from rates. A manufacturer was rated on buildings and houses, and so should be the farmer. At Cardiff, recently, when two agricultural members had moved a stronger resolution, the Minister had pointed out that someone would have to pay for the relief if it could be granted, that under present conditions the Government had not the necessary funds, and he could hold out no hope that the change could be brought about in the lifetime of the present Parliament. This was strange if the Government, as was stated recently, had increased the number of its officials, had the resources of the Road Fund, and were finding money under the Small Holdings Act. Farmers had had no relief from the Government up to the present moment; indeed, more burdens were being put upon them. Industries from which farmers bought were safeguarded, and no safeguarding was forthcoming for agricultural produce. The Valuation Act and the Tithe Act also were going to increase local rates. The Milk and Dairies Order was throwing a heavy expenditure on owners. Mr. BRUFORD seconded the motion. He said that money was being squandered on roads and there was much waste of money all over the country. He thought the Ministry should try and stamp out the depression as it was trying to stamp out Foot-and-Mouth Disease.

The MINISTER, in the course of his reply, said that the Government was anxious to do all it could, within the necessary limits which were well known, to relieve the burden of taxation upon agriculture, both centrally and locally. He was glad that Lord Strachie had now been converted to the conservative policy in this matter. He thought that Lord Strachie's proposal to benefit, not only the agricultural ratepayers, but all rural ratepayers as well, at the expense of the taxpayer, would amount to much more than 4 millions, probably to as much as 9 millions. The Government was responsible for the taxpayers' money, and responsible to the industries of the country as a whole, and he was bound to say quite frankly that, much as he would like to see more done in the way of relieving the burden upon the farmer in his present difficulty, this proposal was absolutely out of the question. Mr. ROBERT HOBBS suggested that there might be some method of meeting the case in a partial way. For example, by a rebate on the rate on the poorer plough land, say, that rated at less than 25s. an acre, so that it would be kept from being laid down to grass. That would

help to keep up employment, and not cost very much. After Lord Strachie had replied to the debate the motion was put to the Council and lost by 21 votes to 18.

Reorganization of Food Council.—Mr. C. B. FISHER, C.B.E. (Northants), moved as follows :—

> That the Council of Agriculture for England suggests that the Food Council might usefully be reorganized by giving the producers and consumers equal representation with a view to bringing their organizations more in touch with one another.

Mr. FISHER said that he did not propose to criticize the work of the Food Council, but only its constitution. It was appointed in 1925 and consisted of 12 members, only one of whom, as far as he knew, was acquainted with agriculture, namely, Mr. C. S. Orwin. The Council was a permanent body, charged with the duty of maintaining a continuous survey of food supplies and prices. His view was that the Council was the right body on which to have representatives of consumers and producers. The Ministry of Food had had a Producers' and Consumers' Council, which met periodically, to the great benefit of both parties. His experience as Chairman of the Travelling Milk Commission was that such meetings had led to good results. Mr. J. O. ADAMS (Northants) seconded. Lord BLEDISLOE said that the Ministry had been in communication with the Food Council and the Board of Trade on this matter. The Food Council had been set up on the lines of having no person representing any particular producing or trade interest on it, and indeed the best of all tribunals of this sort was not one composed of interested parties. He agreed with Mr. Fisher about the work of the Travelling Milk Commission, but war expedients were not such as could be followed in times of peace. If producers were put upon the Food Council, wholesalers and retailers would wish to be similarly represented. The Board of Trade was unwilling to increase the membership of the Council, though it was prepared to meet the resolution to the extent of appointing an agricultural assessor to assist the Food Council in the consideration of every case of British agricultural produce prices. At the instance of the Conservative Parliamentary Agricultural Committee, the prices of fruit and vegetables would shortly be considered, and such an assessor would be appointed. Mr. FISHER, in reply, said that such an appointment would help to some extent, but he did not think it went far enough. The great question was the discussion of matters by consumers' and producers' representatives. It would, no doubt, be very helpful to the Food Council to hear what the producer had

to say as regards condensed skimmed milk importation, also as regards the importation of potatoes. The consumer never got the full benefit of plentiful supplies.

The motion was put to the meeting and carried.

Agricultural Long-Term Credit.—Mr. CHARLES ROBERTS (Cumberland) moved the following resolution :—

> That the Council notes with satisfaction the Prime Minister's statement of his intention to make more credit available for farmers, and to introduce a scheme of long-term credit, and hopes that nothing will prevent a well-considered measure for these purposes from being passed during the coming session into law.

Mr. ROBERTS said he put forward this resolution for the following reasons : that, although it had been stated that the Government would deal with the problem next year, there was some uncertainty because the banks had not yet decided to support the scheme, and the Minister had said at Cardiff that he would proceed with it if the farmers desired it. (The Minister here interposed and said that his statement to that effect referred only to short-term credit.) Mr. Roberts said that if the Minister would define the position and give the Council some indication of the direction in which the mind of the Government was travelling, the Council might be able to give some helpful and constructive criticism. He hoped that long-term credit would not be confined to farmers who had bought their farms in any particular period ; a new method of financing the industry was really required. Taking a long view, he wondered how the capital requirements of farms were going to be met without some change. One turned from the state of things in this country, where the banks found £20,000,000 for land purchase and £26,000,000 for equipment, to the case of Germany, where £400,000,000 had been found on the mortgage credit system, and the United States, where £2,000,000,000 had been similarly found. He drew the conclusion that there was no lack of credit facilities in those countries, as there was here. As regards short-term credit, he hoped that the Government would give a new definition of the chattel mortgage proposed in the Report on Agricultural Credit in 1926. It would be a real help to extricate farmers from their dependence on dealers, auctioneers and traders generally, and it would also help the new co-operative societies.

On the point of a Government subsidy, he did not think one, either direct or concealed, was required. Doles were only temporary expedients and palliatives. A new land bank

giving first mortgages on farms and attracting the investing public by bonds secured collectively on the corpus of the first mortgages, the mortgages being repayable by easy instalments of principal and interest, would be most helpful. He considered that a Government guarantee might help to familiarize investors with this new kind of security and would not seriously weaken the national credit. Sir Francis Acland seconded the motion. The Minister of Agriculture welcomed Mr. Roberts' helpful speech and the opportunity it gave him to clear up one or two doubtful matters. The Government was proceeding generally on the lines of the Report on Agricultural Credit and was aiming at a standard system of long-term reducible mortgages. The negotiations with the banks were going on in a more active form than ever, and he was hopeful that a satisfactory conclusion would be reached. As regards short-term credit, the chattel mortgage would be of great assistance in certain cases, but for various reasons the idea had not found favour with the Farmers' Union, the merchants or the banks. Certain modifications of the original suggestion were being considered, and the Government was quite prepared to deal with the matter on self-supporting economic lines if those who would use the facilities thought it worth while. With the great industrial upheaval last year, or even this year, when we were living in the backwash of the upheaval, the Government did not feel that the time was ripe to go on with agricultural credit schemes. Next year, however, it had every intention of bringing forward the best scheme that it could prepare with the co-operation of the banks and all concerned.

The resolution was put to the meeting and carried.

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NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

WINTER WHEAT, BARLEY AND OATS TRIALS, 1924–27

The National Institute of Agricultural Botany, with the co-operation of the Ministry of Agriculture, the Norfolk Agricultural Station, the Lord Wandsworth Agricultural College, Harper-Adams Agricultural College, Seale-Hayne Agricultural College, and the East Anglian Institute of Agriculture, has just completed a three-year series of wheat trials

and a two-year series of winter barley and winter oats trials. The unusually accurate and comprehensive nature of these trials makes the results worthy of serious attention. Brief particulars of the trial centres are :—

	Soil	Sub-soil	Altitude
Cambridge	Heavy clay ..	Gault	80 ft.
Sprowston, nr. Norwich ..	Gravelly loam ..	Gravelly boulder clay	100 ,,
Long Sutton, Hants	Medium to heavy loam	Clay over chalk..	450 ,,
Leegomery, Salop ..	Sandy loam ..	Sand and gravel..	300 ,,
Good Easter, nr. Chelmsford ..	Heavy boulder clay	London clay ..	200 ,,
Newton Abbot, Devon	Loam of medium depth	Shale	320 ,,

Winter Wheats.—The comparative grain yields of the wheats in 1926-27, and for the three seasons 1924-27, are given in Tables I and II. The yield of the control variety, Squarehead's Master, is taken as 100, and the yields of the remainder are stated as percentages of it. The Long Sutton figures are excluded from the average column of Table II as they are in some respects incomplete.

TABLE I.—1926-27 RESULTS

Cambridge	Cam-bridge	Nor-wich	Long Sutton	Lee-gomery	Good Easter	General average
Browick ..	98·5	101·5	99·0	127·5	98·1	104·9
Wilhelmina ..	116·8	101·1	96·0	126·3	114·6	111·0
Fox ..	100·4	96·0	99·6	98·3	98·3	98·5
Yeoman II ..	100·7	101·8	—	109·2	134·2	111·5
Little Joss ..	111·1	105·1	—	109·2	102·8	107·1
Iron III ..	118·9	101·1	104·1	120·2	110·0	110·9
Weibull's Standard ..	117·8	102·4	88·8	114·0	100·0	104·6
Setter ..	—	103·7	—	—	—	103·7
Squarehead's Master ..	100·0	100·0	100·0	100·0	100·0	100·0

Squarehead's Master is generally the earliest, Iron III and Weibull's Standard the latest to ripen. There is little difference between the remainder. Little Joss has the longest

TABLE II.—AVERAGE OF 1924-27 RESULTS

	Cambridge	Norwich	Long Sutton (*a*)	Leegomery	Good Easter (*b*)	General average excluding Long Sutton
Cambridge Browick ..	98·6	103·6	94·4	111·5	99·7	103·4
Wilhelmina ..	113·5	106·5	96·6	114·4	114·7	112·3
Fox	104·5	100·7	99·2	97·7	93·7	99·2
Yeoman II ..	100·1	102·7	91·5	105·7	114·9	105·9
Little Joss ..	106·5	109·8	95·7	101·4	103·0	105·2
Iron III ..	117·2	92·6	104·1	118·2	105·3	108·3
Weibull's Standard (*b*)	121·0	101·6	—	108·2	97·7	107·1
Setter (*b*) ..	—	95·2	—	—	—	95·2
Squarehead's Master ..	100·0	100·0	100·0	100·0	100·0	100·0

(*a*)=Average of two years only: Yeoman II, Little Joss, and Iron III, one year.
(*b*)=Average of two years only.

and Fox the shortest straw. Fox lodges badly and Little Joss and Squarehead's Master are inclined to the same fault. Yeoman II and Little Joss are the least susceptible to yellow rust; Iron III on several occasions was badly attacked. No one variety was more or less susceptible to "take-all" than any other. Yeoman II is consistently the best for the production of breadmaking flours, with Fox a good second; there is little to choose in this respect between the others. The individual merits of the chief varieties may be summed up as follows:—

Wilhelmina can be relied upon to yield heavily in most districts; it stands well; and does better in the mill than its appearance suggests.

Iron III yields and stands well, particularly on the heavier soils and in the south and west, but clearly is not the best wheat for the gravelly loams of Norfolk, and has shown an unexpected susceptibility to yellow rust. It should be sown early.

Weibull's Standard is a newcomer that yields heavily on the Cambridge clay, with a good straw, but grain of poor quality.

Yeoman II yields rather better than was expected. It can be grown successfully on all the soils described above. It is unique among English wheats for quality, it is rust-resistant, and it stands well enough to pay for intensive manuring.

Little Joss makes the most straw, is rust-resistant, suits light soils, and is clearly the heaviest yielder at Norwich; but it has no claim to quality.

The remainder could well be replaced on any of these soils by one or other of the foregoing. But it should be noted

that these results do not necessarily apply to Northern England.

Winter Oats.—The results for 1926-27 are given in Table III, those for 1925-27 in Table IV. In certain cases only one year's results are available. The yield of Grey Winter, as the control, is expressed as 100.

TABLE III.—1926-27 RESULTS

	Cambridge	Norwich	Long Sutton	Leegomery	Good Easter	Newton Abbot	Average excluding Leegomery
Marvellous..	106·9	118·9	128·7	- -	130·7	89·6	115·0
Bountiful ..	100·0	124·5	114·2	—	91·8	87·0	103·5
Black Winter ..	94·7	103·3	107·3	103·1	97·8	98·6	100·8
Plentiful ..	87·9	107·5	99·1	111·5	97·8	—	100·8
Victory ..	—	- -	—	—	121·7	—	121·7
Grey Winter	100·0	100·0	100·0	100·0	100·0	100·0	100·0

TABLE IV.—AVERAGE OF TWO YEARS' TRIALS, 1925-27
(PLENTIFUL ONE YEAR ONLY)

	Cambridge	Norwich	Long Sutton	Leegomery (a)	Good Easter	Newton Abbot	Average excluding Leegomery
Marvellous ..	116·0	123·4	98·2	·	132·0	103·8	114·7
Bountiful ..	102·1	129·5	99·5	113·0	97·2	103·6	106·4
Black Winter ..	94·5	100·8	102·7	115·1	104·4	100·4	100·6
Plentiful	87·9	107·5	99·1	111·5	97·8	—	98·1
Victory ..	—	—	—	—	121·7	- -	121·7
Grey Winter ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0

(a)=Black Winter two years, remainder one year only.

Marvellous is a coarse white oat that makes few tillers, and a comparatively small bulk of very strong straw, but in sheltered districts generally gives a heavier grain yield than any other winter oat. To sow it in cold or wet districts or on dirty land, however, is to court almost certain failure.

Bountiful is a black oat that produces a good quantity of fairly strong straw, gives a good grain yield, particularly on the lighter soils, and though probably not entirely winter hardy is hardier than Marvellous.

Black and Grey Winters give a bulk of weak straw, and modest but, thanks to their hardiness, steady yields of grain. The quality of the grain of Grey Winter is good, but of Black Winter only moderate. Grey Winters are at once the hardiest, the weakest strawed, and the latest of winter oats.

Plentiful is a new variety from Gartons. One year's trial is too short for reliable conclusions, but Plentiful seems to produce a large bulk of fairly stiff straw and moderate yields of good quality white oats, particularly on the lighter soils, and to be hardier than Marvellous. It is the earliest of all these oats to ripen.

The value of *Victory* as a winter oat depends entirely on its hardiness; one year at one centre is not enough to test this.

Winter Barleys.—The available information is less than for the two preceding crops, but is given in Tables V and VI. The yield of F. 112, as control, is expressed as 100.

TABLE V.—1926-27 Results

	Norwich	Long Sutton	Good Easter	Average
Plumage Archer, 1924	94·3	102·1	118·3	104·9
Spratt Archer ..	96·4	—	82·5	89·5
Sunrise	84·0	—	121·9	103·0
Archer	94·0	—	—	94·0
Squarehead Winter (6-row)	—	95·2		95·2
F. 112 (6-row) ..	100·0	100·0	100·0	100·0

TABLE VI.—Average of Two Years' Trials, 1925-27

	Norwich	Long Sutton	Good Easter	Average
Plumage Archer, 1924	95·3	105·9	—	100·6
Squarehead Winter ..	93·5 (*a*)	96·7	—	95·1
F. 112	100·0	100·0	—	100·0

(*a*) = 1925-26 result only.

To draw conclusions from these scanty data is risky, but F. 112, a new 6-row barley of Dr. Beaven's that has shown signs of malting quality, has yielded better than the ordinary 6-row winter on every occasion, and seems particularly suitable for the light Norfolk soil. It looks, too, as though the experiment of sowing spring varieties in autumn may, in the case of Plumage Archer 1924, justify itself on an average of seasons on the heavier soils, and on the light soils as well if its outstanding quality is taken into consideration. Both these two varieties stand well.

Full reports on these trials will be published later in *The Journal of the National Institute of Agricultural Botany*.

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LICENSING OF STALLIONS UNDER THE HORSE BREEDING ACT, 1918

THE number of stallions licensed under the Horse Breeding Act, 1918, in England and Wales, during the licensing year ended October 31, 1927, was smaller than in the previous year, but the rate of decrease was much less rapid than in any preceding year since the Act came into force. It would therefore appear that the sharp decline in horse-breeding which has been taking place in the past few years is now coming to an end.

The total number of licences issued for the service season of 1927 was 1,537, a reduction of only 71 as compared with 1926, whereas the decrease recorded last season was 241.

Service Season	1921	1922	1923	1924	1925	1926	1927
Shires	2,463	2,174	1,634	1,195	953	829	772
Other heavy horses ..	636	591	486	424	350	324	328
Light horses (including ponies)	717	714	641	591	546	455	437
Totals	3,816	3,479	2,761	2,210	1,849	1,608	1,537

TABLE II

BREED	Number examined	Number refused	Percentage refused	DISEASE							
				Roaring	Whistling	Sidebone	Ringbone	Cataract	Defective Genital Organs	Bone Spavin	Stringhalt
PEDIGREE											
Shire	751	19*	2·5	5*a*	9*b*	3*c*	—	1	—	—	1
Suffolk	143	4†	2·8	1	3*d*	—	—	—	—	—	—
Percheron ..	42	1	2·4	—	—	1	—	—	—	—	—
Thoroughbred ..	154	4†	2·5	—	1*e*	—	—	2	—	1	—
Hackney	83	2	2·4	—	—	—	—	1	—	—	1
NON-PEDIGREE											
Heavy	82	4†	4·9	—	—	1	1	2	—	—	—
Light	29	1	3·8	—	—	—	—	—	1	—	—
Pony and Cob ..	27	2	7·4	—	1	—	—	1	—	—	—
Total Refusals ..	—	37	—	6	14	5	1	7	1	1	2

* Including three refused on previous year's examination.
† Including one refused in each case on previous year's examination.
(*a*) One also affected with Cataract.
(*b*) „ „ „ Roaring.
(*c*) „ „ „ Stringhalt.
(*d*) „ „ „ „ and Bone Spavin.
(*e*) Also affected with Bone Spavin.

TABLE I

PEDIGREE STALLIONS *i.e.*, Stallions entered or accepted for entry in the recognized stud book of their breed	BREEDS, HEAVY					BREEDS, LIGHT								BREEDS, PONY AND COB								TOTAL
	Shire	Clydesdale	Suffolk	Percheron	—	Hackney	Thoroughbred	Arab	Cleveland Bay	Welsh Roadster	Hunter	Yorkshire Coach	—	Welsh	Fell	Dales	Polo and Riding	Shetland	Welsh Cob	Dartmoor	—	
Licensed	732	110	139	41	—	81	150	12	5	1	4	2	—	19	18	9	21	9	52	1	—	1,406
Refused	19	—	4	1	—	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30
Applications	751	110	143	42	—	83	154	12	5	1	4	2	—	19	18	9	21	9	52	1	—	1,436
NON-PEDIGREE STALLIONS *i.e.*, Stallions not entered or accepted for entry in a recognized stud book	TYPES					TYPES								TYPES								
	Shire	Clydesdale	Suffolk	Percheron	Others	Hackney	Thoroughbred	Arab	Cleveland Bay	Welsh Roadster	Hunter	Yorkshire Coach	Others	Welsh	Fell	Dales	Polo and Riding	Shetland	Welsh Cob	Dartmoor	Others	
Licensed	40	11	—	1	26	16	3	5	—	1	2	—	1	2	3	6	1	—	13	—	—	131
Refused	1	—	—	—	3	1	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	7
Applications	41	11	—	1	29	17	3	5	—	1	2	—	1	2	3	7	1	—	14	—	—	138
Total licensed	772	121	139	42	26	97	153	17	5	2	6	2	1	21	21	15	22	9	65	1	—	1,537
Total refused	20	—	4	1	3	3	4	—	—	—	—	—	—	—	—	1	—	—	1	—	—	37
Total applications ..	792	121	143	43	29	100	157	17	5	2	6	2	1	21	21	16	22	9	66	1	—	1,574

The percentage decreases in the totals of heavy and light horses respectively were fairly similar, but it is noteworthy that the whole of the reduction in heavy horses was in Shires.

In 40 cases, applications for licences were refused by the Ministry, but appeals against refusals were lodged under paragraph 12 of the Regulations in six cases, and three appeals were successful.

Very few cases again of infringement of the Act were reported this season. Only one unlicensed stallion was reported on the road, while in two cases unlicensed stallions were reported as being exhibited for service. Proceedings were taken by the police in one case, and a conviction obtained. Nine stallions, though licensed, were found to be travelling unaccompanied by the licences.

Stallion owners in possession of licences for the year ended October 31, 1927, are reminded that these licences expired on that date, and should have been returned to the Ministry. Applications for renewal, as well as for new licences, should be made as early as possible on forms which may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

* * * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1927

Produce of Hops.—Preliminary statement showing the estimated total production of hops in the years 1927 and 1926, with the acreage and estimated average yield per statute acre in each county of England in which hops were grown; and the average yield per acre of the ten years, 1917-1926. (See table opposite.)

The average yield per acre in England this year is estimated at 11·1 cwt. per acre as compared with 13·0 cwt. last year, and at ¾ cwt. below the ten years' average. The heaviest crop was obtained in Kent, where the yield over the whole county was 11½ cwt. per acre, being slightly more than 2 cwt. under last year's figure, and 1½ cwt. below the average.

In the Weald, the yield was less than 10¾ cwt. per acre or 1½ cwt. below average. Mid and East Kent obtained crops of 11½ cwt. and nearly 13 cwt. per acre respectively, the former being 2½ cwt. and the latter ⅓ cwt. per acre below the ten years' average for those districts. The yield in Sussex is estimated at 10⅓ cwt., which is almost 3 cwt. less than last year, and nearly 1 cwt. per acre below the average. Hampshire

Counties, etc.	Estimated Total Produce		Acreage Returned on June 4		Estimated Average Yield per Acre		
	1927	1926	1927	1926	1927	1926	Average of the Ten Years, 1917-26
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Kent — East	41,000	53,000	3,173	3,496	12·9	15·2	13·2
Kent — Mid	55,000	78,000	4,790	5,259	11·5	14·8	14·0
Kent — Weald	68,000	82,000	6,329	6,941	10·7	11·8	12·1
Kent — Total, Kent	164,000	213,000	14,292	15,696	11·5	13·6	13·0
Hants	8,900	14,400	948	1,034	9·4	13·9	11·2
Surrey	1,600	2,200	150	177	10·8	12·5	10·3
Sussex	22,000	31,000	2,149	2,384	10·3	13·2	11·2
Hereford	41,000	49,000	3,593	4,166	11·3	11·7	9·4
Worcester	17,000	21,000	1,773	2,032	9·8	10·4	9·7
Other Counties*	1,000	1,400	99	110	10·1	12·5	8·1
TOTAL	255,500	332,000	23,004	25,599	11·1	13·0	11·9

* Salop, Gloucester, and Berkshire.

NOTE.—Inquiries made during the past month indicate that the area of hops actually picked was less than the area returned on June 4. The estimated total produce shown above for 1927 represents the quantity estimated to have been picked.

with a yield of under 9½ cwt. was 1¾ cwt. per acre under average. The West Midland counties, however, produced above average crops, although these were about ½ cwt. below last year's figures. Hereford with a yield of 11⅓ cwt. per acre was nearly 2 cwt. above average, whilst Worcester, with a little more than 9¾ cwt. per acre, was only slightly in excess of the average for the previous ten years.

The total production over the whole of England in 1927 is estimated at 255,500 cwt. or 76,500 cwt. less than last year and 15,000 cwt. below the average production of the ten years 1917-1926. As was the case last year, Kent produced 64 per cent. of the total hop crop, but the quantity was only 164,000 cwt. as compared with 213,000 cwt. in 1926.

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DECEMBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
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Seasonal Notes.—December, like the three preceding months, owes its name to its position in the old Roman year, which commenced in March. Thus it was, as its name implies, the tenth month. By our Saxon ancestors it was known as Winter-monath, and later as Helig-monat or Holy month. Even before the institution of Christmas celebrations, this time of the year was one in which there was much holiday-making and feasting in rural districts. The field operations of the year being completed, this was obviously the season when a little relaxation from agricultural labours could be most conveniently arranged.

In ancient Latium, the Saturnalia or festival of Saturnus, the god of agriculture, was celebrated about the middle of December. During the week of this festival no public business could be transacted; the slaves enjoyed special liberties, and all ranks devoted themselves to feasting, games and mirth. The houses were decorated with evergreens, presents were interchanged, and other customs were observed which exhibit a remarkable resemblance to those of our own Christmas.

The hanging up of the mistletoe is a survival of the Druidical rites that were performed at the time of the winter solstice. The mysterious protective and curative properties of the plant were, however, attributed only to specimens found growing on the oak. The burning of the Yule log is an ancient ceremony handed down from our Norse ancestors, who were

sun worshippers, and on the shortest day kindled huge bonfires in honour of the beginning of the lengthening of the hours of daylight.

With the change in rural organization and the greater facilities for recreation now available, seasonal festivities tend to hold a less prominent position than formerly. Many old customs observed at this time of the year have entirely disappeared. The lapse of one of these, at any rate, is not a matter for regret: it was the custom of "blooding" the horses on St. Stephen's Day, December 26. The horses were first galloped until they perspired freely, then they were bled copiously. This superstitious rite was believed to insure the animals against maladies and sickness during the ensuing year.

Field Operations.—December is often a month when the soil is so continuously wet that drilling of corn is impossible, and such seed as is sown must be covered either by skim ploughing or merely by harrowing. From about the middle of the month until mid-January, however, the soil temperature is commonly so low that, in the greater part of the country, seed put into the ground lies dormant until the return of milder conditions in the latter month. Some farmers believe that the influence of low temperature is beneficial to grain production, but there is evidence that winter oats at least yield equally well if sown after the coldest weather has passed. It is remarkable, however, how long December-sown seed can lie in the soil and then come up well when warmer conditions return.

Apart from attention to live stock, farm operations in this month consist partly in taking advantage of periods of dry weather or hard frost for carting out manure, cross ploughing, winter ridging and splitting of ridges, completing the ploughing of stubbles and other operations in which horse labour may be utilized, and partly in fill-up duties in which only manual labour can be applied. Opening drain mouths, cutting grips and furrows across headlands to lay corn land dry, pleaching hedges, overhauling implements and machinery in readiness for next season, repairing roads and gateways and similar jobs are all necessary, and when thoroughly carried out facilitate progress in the busy seasons. Draining, slagging and liming are larger operations for which opportunities can usually be found in this month.

Loss of Plants.—It is necessary in farm practice to sow several times as much seed corn as would be needed to produce a full stand of ears if every seed produced a mature plant.

A large proportion of the seedlings perish during the winter, so that, instead of two plants per inch of drill row, a seedling every two inches is a good stand ; and, when it comes to the point of deciding whether to plough up or leave a thin plant of wheat in March, one plant in six inches may be deemed sufficient to avoid re-sowing. It might be thought that by the operation of the law of natural selection a very hardy strain of wheat would be obtained by saving seed grown on the farm ; but the thinning out of the plant in winter is caused by so many different factors that the seedlings which survive the conditions of one field or one winter may not be the most capable of enduring the winter conditions of another field or season.

Late-sown corn is subject to the depredations of birds, larks especially, which pull up the blade during germination to get at the seed corn at its foot. The larvæ of frit fly, wheat bulb fly, wireworms and slugs may under certain conditions levy heavy toll on winter corn during the milder weather. The braird obtained from weakly germinating seed—such as often results after wet harvest weather—is prone to thin off badly in winter ; but the more common causes of loss of plant between November and March are those of a physical nature. These produce the four separate troubles of (1) throwing out, (2) drowning out, (3) freezing off, and (4) rotting off.

Throwing out is the name given to the damage caused by alternate freezing and thawing, when the stem is torn through between the seed-corn and the blade. When a light frost occurs on a moisture-laden seed bed, the surface is lifted, and when the soil goes down after thaw and perhaps rain, the plant stands higher out of the ground than it did before. When a more severe frost is followed by a surface thaw and then frost returns while the roots are still bound in the frozen part of the soil, the upper part of the plant is torn away from the lower part and later remains detached and projecting out of the ground. Late-sown wheat drilled too deeply on moist land is most subject to this trouble. Fields lying towards the sun are worse in this respect than those with a northern aspect, as they thaw during the warmer parts of the day and freeze again at night. During the time when snow is on the ground, the melting of the snow in the middle of the day adds to the moisture content and increases the expansion of the soil on freezing. Loose seed beds and corn drilled on leas that have not been ploughed early enough are more prone

to this trouble than fields prepared in accordance with the accepted rules. Drainage and water-furrowing are necessary preventive measures.

Drowning out is caused by such an excess of moisture in the surface layers of the soil that the rootlets are unable to obtain the air necessary to their life. Working the seed bed too fine may be one cause of the trouble; an impervious subsoil may be another; lack of surface drainage due to flat ploughing and absence of water furrows may be a third cause. The crop suffers more in mild than in cold weather, when excess of moisture is the trouble, and a quick thaw after snow may aggravate the complaint. As in other cases of excess of moisture, prevention of the excess should also be tried by opening ditches which lie on the higher side of the field, thereby preventing seepage of moisture from the higher levels.

Freezing off occurs only when the frost is severe and the land not covered with snow, and also when the effects of the frost are accentuated by sharp dry winds or sunshine. It is probably a drying effect as much as a rupture of the plant tissues. The higher parts of a field are more likely to suffer from this cause than the lower-lying parts, which may escape the winds somewhat. A rough seed bed, with clods that shelter the seedlings from the wind, is the time-honoured method of preventing this complaint.

Rotting off is the trouble which may overtake a winter-proud piece of winter corn when snow comes and its surface becomes first thawed and then frozen to an air-tight cap. If frost precedes the snow, little harm results, because the breathing activities of the plant are thereby retarded; but, when the roots are able to continue their activities and the leaves are cut off from the air, they yellow off and die. Late-sown corn, having only small leaves, is free from this danger.

Farm Economics.—There is no difficulty in realizing that information derived by research in agricultural chemistry, botany, bacteriology and other applied sciences can be of great service to the farmer. Likewise a knowledge of the results of farm experiments and of the methods of husbandry pursued by successful farmers in different districts is of easily recognizable value to all who desire to review and improve their practice. Although perhaps the most important branch of agricultural study, economics has not in this country as yet gained the recognition to which it is entitled by reason of its intimate connexion with the main objects of the farmer —the earning of profit. Scientific manuring, correct feeding,

and even the efficient execution of farm operations are not in themselves the end but only the means to the end.

That 50,000 German farmers are co-operating in the investigation of the financial aspects of farming—by having their accounts properly kept and co-ordinated—is a fact that should at least raise the question of whether our farmers have given this matter sufficient attention. The importance which the Germans attach to this work may be better understood when it is explained that they have about 500 farm book-keeping offices which carry out the accountancy work, and that these offices are self-supporting institutions, organized by the agricultural societies and chambers, and maintained by the fees charged for their services.

Interest in farm economics work is of later origin in this country; we have now, however, in addition to the Institute for research in this subject at Oxford, specialist economic advisory officers at the agricultural colleges or university agricultural departments at Newcastle, Leeds, Sutton Bonington, Cambridge, Oxford, Wye, Reading, Newton Abbot, Bristol, Newport, Manchester and Aberystwyth. Each of these officers is making investigations into farming costs and returns on as many farms in his area as his facilities will permit, or as the farmers in his area will collaborate to ensure. In the Bristol area, an Accounting Society has been formed with a membership of about 50 farmers.

Some of the above-mentioned advisory officers have recently published reports, or interim reports, on the results of their first three years' work; but it must suffice here to state some of the main objects of the investigations. Perhaps the first is to work out standards by which economic efficiency in farming can be measured. Just as a crop of wheat is regarded as good or otherwise in comparison with a standard of four quarters per acre, so we require standards with which to compare the financial data of farming—to enable us to say, for example, whether in a given case an expenditure of £25 in labour per £100 of produce obtained, is higher or lower than it might be under ordinary good management.

Other objects are to obtain authentic data on the financial results of agriculture at different times and under different systems; to compare extensive and intensive methods; and to investigate the influence of various factors on production costs. There is no doubt that when the requisite fundamental data have been established, the farmer will have the further incentive to keep proper accounts, *viz.*, that he will be able to make excellent use of the advisory facilities at his disposal.

NOTES ON MANURES FOR DECEMBER

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Liming.—December is not a very active month as far as the application of manures is concerned, but suitable slack periods often arise which enable chalking or liming to be undertaken. The liming of land, although widely practised in former years, tends to be neglected at the present day. The cost is often considerable, and when the land is only slightly acid the effects are neither so striking nor immediate as those associated with the use of fertilizers. The benefit of liming in such cases consists of a distinct and lasting all-round improvement in the performance of the land as regards cropping and workability, rather than a rapid and transient increase in fertility. In more serious cases of soil sourness, however, the lack of lime is the governing factor, and until this is remedied, fertilizers used alone have little effect, and certain crops fail entirely. The addition of lime to heavy land, which is working badly owing to lime shortage, will often bring about such an improvement as to put the treated land into a different class. At Rothamsted, areas which have been chalked in former years are easily distinguished from the neighbouring untreated land by their better working qualities. The mellower appearance of the chalked areas can often be noted from a considerable distance.

It is now recognized that certain crops are more sensitive than others to soil acidity. Some will fail in the absence of lime on soil on which others can flourish. Lucerne, clovers, barley, and sugar beet fall into the first group; potatoes, oats, and rye are well-known examples of crops which can tolerate a certain degree of acidity. The nature of the crop to be grown is therefore a factor to be considered when the liming of land is in question.

The increasing cultivation of sugar beet will no doubt cause much land, which grew potatoes quite well, to be carefully examined for lime deficiency. A case of this kind occurred at the Woburn Experimental Farm when a series of sugar beet plots was put down on land which could grow good potatoes but turned out to be sour in places. The coincidence of a dense growth of spurrey, and failure of the beet in patches, was very striking; in other places much less spurrey was seen and the beets were good.

Farmers are advised to consult their County Agricultural Organizer before undertaking the liming of a field, for cases have occurred in which it was proposed to lime land that on examination turned out to be naturally supplied with chalk. Moreover, the adviser can give a good indication of the correct amount of lime to use. Too light an application may still leave the land acid, while damage can result from heavy doses of quicklime, especially on light soils.

Mixing Fertilizers.—The practice of mixing artificials on the farm has much to recommend it where farmers have the necessary knowledge of the properties of the individual fertilizers, and are prepared to take a little trouble to carry out the work thoroughly.

A few points need attention if the best results are to be obtained. A good dry manure shed, with a concrete mixing floor and separate bins for the raw materials, is a great advantage, as with storage accommodation it is possible to purchase requirements in good time and, frequently, at favourable prices. It is also essential to know what constituents may be mixed satisfactorily in order to avoid the losses which may arise when unsuitable materials are brought together. These losses are of three kinds :—

(1) Loss of plant food.
(2) Loss of water solubility.
(3) Loss of physical condition.

The best example of the first case is the loss of ammonia which results on mixing salts of ammonia, such as the sulphate or muriate, with lime, or materials containing lime, *e.g.*, basic slag.

The second case arises if water soluble phosphates are mixed with lime or substances containing it. The damage here, though appreciable, is perhaps not so serious as in the former case.

The last case is especially troublesome to farmers, as materials which run together and cake on mixing are very difficult to handle subsequently and regrinding is not possible on the farm.

Samples of manures which, through bad storage facilities, have picked up moisture and become sticky are to be avoided in making mixtures ; but some fertilizers—*e.g.*, nitrate of lime and to a less extent nitrate of soda—become damp when exposed to the air, even under the best conditions, and are best applied alone.

A little stickiness can be got over by the use of a small proportion of a conditioner, such as steamed bone flour, while if some of the nitrogen is supplied in the form of organic manures—*e.g.*, dried blood, rape dust, and so forth—the mechanical conditions of the mixture are improved, although the cost per unit of nitrogen will be a little higher.

A good way of mixing the constituents is to spread them in thin layers, one on top of the other, on the floor; then shovel the whole into a heap, taking care to get some of each constituent in each shovelful by shovelling right to the bottom of the layers. The main heap should be turned several times and finally passed through a $\frac{1}{2}$-in. screen. The material held on the screen may then be pulverized with a suitable rammer or the back of a shovel and added to the bulk, which should then be turned again, and, for specially good working, the mixture may then be passed through a $\frac{1}{4}$-in. riddle.

Since mixtures which have been skilfully compounded will sometimes lose condition on storage, it is advisable to use home-made compounds as soon after mixing as possible. In addition to the ordinary compound fertilizers, something has been done in recent years to supply two or more constituents ready mixed to meet certain definite needs. For example, those who know by experience that their grassland needs potash as well as phosphate, can supply the two together by using one of the various mixtures of phosphatic manures and potash salts which are on the market. On the Continent a beginning is being made with high-grade complex fertilizers of known composition and constituents whose balance is varied to suit different soil types and crop requirements. These products are more concentrated and more fully declared in their composition than the ordinary compounds as known in this country, and their progress will be watched with interest.

Manures for Sugar Beet.—Interest continues to be shown in the food requirements of sugar beet, as it is generally admitted that good manurial treatment is necessary to make the most of the crop. It should be emphasized, however, that correct manuring will not cover up deficiencies caused by faulty cultivation and, of the two factors, the latter is probably the more important. Much work has been done on the Continent concerning the effect of manures on the yield and quality of sugar beet and, while the results cannot be taken over into English practice without confirmation, the

main findings do, at any rate, give us a guide as to what to expect in our experiments.

In his book on sugar beet culture, Professor Roemer sets out the evidence relating to the manuring of sugar beet in Germany.* Some of the points made are as follows :—

(1) The crop has great powers of utilizing the soil supply of plant nutrients, but manuring is necessary, nevertheless, to obtain satisfactory yields.

(2) A medium application of dung, not exceeding 12 tons per acre, is the basis of the manuring and should be ploughed in before the new year. Heavy quantities of good dung applied late tend to delay ripening. The use of dung considerably reduces the quantity of artificials required.

(3) Green manure is valuable as an economizer of farmyard manure, but not as a substitute.

(4) Nitrates, ammonium salts, and cyanamide are effective in the order named, the superiority of nitrates being more marked in dry districts. The two latter sources of nitrogen should be applied before sowing. Top dressing should be confined to nitrates, and, to avoid late ripening, application should not be delayed after mid-June. Used in moderation and properly applied, artificial nitrogenous manures do not depress the sugar content.

(5) A readily available supply of phosphate should be at the disposal of the plant in early life. Water-soluble phosphate is recommended for this purpose.

(6) Potash is required except on rich soils where generous dunging is given. Muriate of potash suits the heavier soils, and the salt in the low-grade potash salts is beneficial on the light soils. Potash exerts a small but favourable influence on the sugar content. Potash salts should be applied well before sowing time, the lower the grade the greater being the interval. Winter application of potash manures is good practice, except on light soils.

(7) Liming is necessary to success on acid soils, but on light soils too much lime may damage the crop.

(8) Dressings recommended for German conditions are :—

	No Dung	*With Dung*
Muriate of potash or equivalent	2 cwt. per acre	0-1½ cwt. per acre
Superphosphate or equivalent	3-4 ,, ,,	1½-2 ,, ,,
Nitrate of soda or equivalent	3½-5 ,, ,,	1¾-3½ ,, ,,

It is pointed out, however, that these general recommendations should be modified to suit local soil and agricultural conditions.

* *Handbuch des Zuckerrübenbaues* : Berlin, 1927.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending November 9				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 7	11 7	14 8
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 5*	10 5*	10 5*	10 5*	9 11
Calcium cyanamide (N. 19%) ..	8 12‡	8 12‡	8 12‡	8 12†	9 1
Kainit (Pot. 14%)..	3 2	2 17	2 19	2 19	4 3
Potash salts (Pot. 30%)	4 17	..	..	4 15	3 2
„ (Pot. 20%)	3 12	3 2	3 9	3 8	3 5
Muriate of potash (Pot. 50-53½%)	9 10	8 5	8 17	9 12	3 7
Sulphate „ „ (Pot. 48-51½%)	11 10	10 5	11 1	11 12	4 6
Basic Slag (T.P. 32%)	3 8§	3 3§	3 3§	..	..
„ (T.P. 30%)	3 6§	3 1§	3 1§	2 15*e*	1 10
„ (T.P. 28%)	..	2 12§	2 13§	.	..
„ (T.P. 26%)	..	2 6§	2 7§	..	..
„ (T.P. 24%)	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10*d*	0 10
Fine grade‖	2 10	..	..	2 7*d*	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 4	3 0	1 9
„ (S.P. 33%) ..	..	..	3 2	..	..
„ (S.P. 30%) ..	2 15	2 15	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 7	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	5 17†	6 2†	6 5	5 17	.
Burnt Lump Lime	1 9	1 12*a*	1 16*b*	2 1§	..
Ground Lime	1 18	2 1*a*	2 6*b*	1 15§	..
„ Limestone	..	..	1 10*b*	..	..
„ Chalk	..	1 9	..	1 5§	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station.

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull. *b* Delivered to Liverpool area.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.O.R. Northern rails; 3s. 6d. per ton extra on Southern rails.

NOTES ON FEEDING STUFFS FOR DECEMBER

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The Manurial Value of Sugar Beet Tops.—Inquiries are frequently made as to the value which should be assigned to sugar beet tops when they are ploughed into the land as manure. With the object of securing reliable information on this matter, numerous samples of beet tops were collected for examination from a large number of farms in the Eastern Counties during the harvesting of the 1926 crop. The writer would like to take this opportunity of thanking all those farmers who so willingly co-operated with us in the carrying out of this investigation.

For purposes of comparison, the samples were divided into four broad groups, according as to whether they were grown on light, medium, heavy or fen soils. The samples were received over a period of about two months, beginning October 8, 1926. Every sample as it arrived was chopped up in a large mechanical meat-mincer fitted with revolving knives. The minced mass was well mixed, and representative samples of known weight were dried down in a steam oven for the moisture determination. The dried residues were finely ground up, and, after air-drying, were utilized for analytical purposes.

The three constituents to be estimated for a determination of manurial value are nitrogen, phosphoric acid and potash. In view of the small extra labour involved, however, it was decided to secure further data in respect of content of total ash, silica, soda and lime. The mean results for the four groups of beet tops are recorded in Table I.

TABLE I.—NITROGEN AND MINERAL CONTENT OF SUGAR BEET TOPS.
(Results Given as Percentages of Dry Matter.)

Soil Type	*Nitrogen*	*Total Ash*	*Silica*	*Phosphate*	*Potash*	*Soda*	*Lime*
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Light ..	2·00	19·63	5·22	0·68	3·56	2·70	1·86
Medium .	1·85	19·16	5·57	0·57	3·07	2·78	2·31
Heavy ..	2·12	17·49	1·61	0·56	3·53	2·06	3·65
Fen ..	2·38	16·21	0·52	0·48	3·34	3·15	1·84

Since considerable variation was found in the mineral composition of samples of beet tops included in any one group, care must be exercised in attempting to discover correlations between mineral content and soil type. The only conclusion

that can be drawn with certainty is that fen-grown tops contain much smaller percentages of silica than beet tops from other types of soil. It would appear from the results which were obtained for the individual samples that the mineral composition is more affected by chemical factors, such as manurial treatment, soil reaction and so forth, than by the mere physical characters of the soil.

It will be noted that, in general, sugar beet tops are extremely rich in inorganic constituents, the quantity of total ash in the individual samples ranging from 13·7 to 26·0 per cent., with an average value of 18·5 per cent. The mean percentages of silica-free ash in the samples from the heavy and fen soils show striking agreement, being 15·9 and 15·7 per cent. of the dry matter respectively. The corresponding figures for the light and medium soil samples of tops were 14·4 and 13·6 per cent. respectively.

Other general features which were brought out consistently by the analytical results are: (1) the high percentages of potash, soda and lime in the tops, and (2) the relatively low percentage of phosphoric acid. These facts are further illustrated by the figures recorded in Table II, where the average composition of the silica-free ash in the sugar beet tops is compared with corresponding data for mangold leaves.

TABLE II.—MINERAL COMPOSITION OF BEET TOPS AND MANGOLD LEAVES.

(Results Given as Percentages of Silica-free Ash.)

	Beet Tops *Per cent.*	*Mangold Leaves* *Per cent.*
Lime (CaO)	14·5	11·0
Phosphoric acid (P_2O_5)	4·0	6·7
Potash (K_2O)	23·2	31·8
Soda (Na_2O)	19·0	20·1

Table II indicates that mangold leaves display the same characteristics in respect of mineral composition as do sugar beet tops. The proportion of phosphoric acid is low, whereas lime, soda and potash, especially the last-named, are present in large amount. The high percentage of soda is of special interest, explaining why the mangold crop responds successfully to dressings of nitrate of soda mixed with common salt, and suggesting that, in certain circumstances, lack of sodium compounds might constitute the limiting factor in the growth of the sugar beet crop. It looks as if the nitrogen supplied to this crop should always be given, in part at any rate, in the form of nitrate of soda.

The necessary data for calculating the manurial value of a ton of fresh sugar beet tops are given in Table III. Owing to

the low dry-matter content which characterizes the heavy yields of tops obtained on fen soils, it is necessary to adopt a separate standard, as shown in Table III, in assessing their manurial value.

TABLE III.—MANURIAL CONSTITUENTS IN FRESH SUGAR BEET TOPS.

	Average (excluding fen-tops) (Percentage dry matter = 17·2 per cent.) Per cent.	*Fen-grown Tops (Percentage dry matter = 12·9 per cent.)* Per cent.
Nitrogen	0·34	0·31
Phosphoric Acid	0·11	0·06
Potash	0·58	0·43

If the beet tops are ploughed into the land, it may be assumed that the whole of the nitrogen, potash and phosphoric acid is available as manure. If stock are allowed to consume them off the land, then it is assumed that only half of the nitrogen and three-quarters each of the potash and phosphoric acid go into the resultant manure. The current price per unit of the manurial constituents, as recorded month by month in this JOURNAL, should be employed for calculating the manurial value per ton. Thus, on the basis of the October prices, one ton of ploughed-in beet tops would have a manurial value of 5s. 11d., while for tops consumed off the land the value would be 3s. 6d. per ton.

In order to calculate the manurial value per acre, it will be necessary to weigh the yield of tops from a small plot of known area and then arrive at the desired figure by the process of simple arithmetic. Examples of the yields of both tops and roots from crops grown on typical soils are given in Table IV, which has been compiled from data very kindly supplied by the writer's colleagues, Mr. J. C. Leslie and Mr. F. Hanley. In studying these figures, it should be remembered that they have been secured in a season, namely 1927, which has been somewhat abnormal from the standpoint of the sugar beet crop. In particular, the weather conditions have been such as to favour the abundant growth of beet foliage.

TABLE IV.—YIELDS OF BEETS AND BEET TOPS ON TYPICAL SOILS (1927)

Type of Soil	*Beets (unwashed)* *Tons per acre.*	*Beet Tops* *Tons per acre.*
Black fen over clay ..	11·6	20·9
Gravel loam	10·4	13·4
Medium land over chalk	18·8	12·4
Medium land over gravel	17·0	12·1
Typical light land ..	8·9	11·7
Light land over chalk ..	9·1	10·8

It must also be borne in mind that, quite apart from the potassic, phosphatic and nitrogenous constituents, beet tops contain a large percentage of non-nitrogenous organic matter. The beet sugar component will presumably undergo very ready breakdown in the soil, without, however, contributing materially to fertility. It is this consideration which, in the writer's opinion, constitutes the main objection to the wholesale ploughing-in of beet tops. Surely it is better to secure productive utilization of such energy-rich sugar (say 300lb. to 400 lb. per acre) in the bodies of farm animals than to allow it to decompose wastefully in the soil. Whether the incorporation of such amounts of sugar will affect the activities of the bacterial population of the soil, the writer is not in a position to state with certainty. Investigations at Rothamsted, however, have shown that the addition of the simpler carbohydrates to the soil causes a rapid increase in bacterial numbers, and further, that actual increases of nitrogen, presumably through the agency of Azotobacter, occur in soils to which sugar has been added.

With this month's account, the writer will conclude these notes on the subject of sugar beet tops. We are engaged at the present time in making a study of the nutritive properties of another important beet by-product, namely, sugar beet pulp, and it may be that an opportunity will arise for the discussion of the results of this investigation when, in due course, the sugar beet season of 1928 comes round. Meanwhile, for the benefit of readers who may desire more detailed information than it has been possible to give in these Notes, the following list of references is appended:—

(1) "The Utilization of Sugar Beet By-Products." H. E. Woodman, JOUR. MIN. AGRIC., XXXIII, 109, 1926.

(2) "The Ensilage of Sugar Beet Tops." H. E. Woodman and A. Amos, *Jour. Agric. Sci.*, XVI, 406, 1926.

(3) "The Nutritive and Manurial Values of Sugar Beet Tops." H. E. Woodman and J. W. Bee, *Jour. Agric. Sci.*, XVII, 477, 1927.

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DESCRIPTION	Price per qr. s. d.	lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	10 17	0 13	10 4	72	2 10	1·52	9·6
Barley, British feeding	—	—	10 15	0 10	10 5	71	2 11	1·56	6·2
„ Canadian No. 3 Western	38 6	400	10 15	0 10	10 5	71	2 11	1·56	6·2
„ American	37 3	„	10 8	0 10	9 18	71	2 10	1·52	6·2
„ Persian	36 0	„	10 2	0 10	9 12	71	2 8	1·43	6·2
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1·70	7·6
„ „ black and grey	—	—	9 15	0 11	9 4	60	3 1	1·65	7·6
„ Irish, white	—	—	10 13	0 11	10 2	60	3 4	1·78	7·6
„ „ black	—	—	9 10	0 11	8 19	60	3 0	1·61	7·6
„ Argentine	28 9	320	10 2	0 11	9 11	60	3 2	1·70	7·6
Maize, Argentine	35 0	480	8 3	0 10	7 13	81	1 11	1·03	6·8
Beans, English, winter	—	—	8 10*	1 6	7 4	66	2 2	1·16	20
Peas, English, blue	—	—	15 15*	1 2	14 13	69	3 2	1·70	18
„ Japanese	—	—	26 15†	1 2	25 13	69	7 5	3·07	18
Dari, Egyptian	—	—	10 10	0 12	9 18	74	2 8	1·43	7·2
Rye, homegrown	—	—	10 5	0 13	9 12	72	2 8	1·43	9·1
Millers' offals—									
Bran, British	—	—	8 7	1 3	7 4	42	3 5	1·83	10
„ broad	—	—	9 5	1 3	8 2	42	3 10	2·05	10
Middlings, fine, imported	—	—	10 5	0 18	9 7	69	2 9	1·47	12
„ coarse, British	—	—	9 2	0 18	8 4	58	2 10	1·52	11
Pollards, imported	—	—	8 0	1 3	6 17	60	2 3	1·20	11
Meal, barley	—	—	11 15	0 10	11 5	71	3 2	1·70	6·2
„ maize	—	—	9 5	0 10	8 15	81	2 2	1·16	6·8
„ „ S. African	—	—	8 12	0 10	8 2	81	2 0	1·07	6·8
„ „ germ	—	—	9 2	0 16	8 6	85	1 11	1·03	10
„ „ gluten feed	—	—	9 0	1 1	7 19	76	2 1	1·12	19
„ locust bean	—	—	8 17	0 8	8 9	71	2 5	1·29	3·6
„ bean	—	—	12 0	1 6	10 14	66	3 3	1·74	20
„ fish	—	—	21 0	3 10	17 10	53	6 7	3·53	48
Maize, cooked flaked	—	—	10 12	0 10	10 2	85	2 5	1·29	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 10	1 10	11 0	74	3 0	1·61	25
„ „ „ 10% „	—	—	12 0	1 10	10 10	74	2 10	1·52	25
„ „ „ 9% „	—	—	11 15	1 10	10 5	74	2 9	1·47	25
Soya bean „ 6% „	—	—	11 10	2 3	9 7	69	2 9	1·47	36
Cottonseed cake „ 5½% „	—	—	7 7	1 8	5 19	42	2 10	1·52	17
„ „ Egyptian, 5½% „	—	—	7 2	1 8	5 14	42	2 9	1·47	17
Decorticated cottonseed meal, 7% oil	—	—	11 7†	2 3	9 4	74	2 6	1·34	35
Coconut cake, 6% oil	—	—	10 0	1 5	8 15	79	2 3	1·20	16
Ground-nut cake, 7% oil	—	—	10 7	1 8	8 19	57	3 2	1·70	27
Decorticated ground-nut cake, 7% oil	—	—	11 10*	2 3	9 7	73	2 7	1·38	41
Palm kernel cake, 6% oil	—	—	9 0*	0 18	8 2	75	2 1	1·12	17
„ „ „ meal, 6% oil	—	—	9 10*	0 18	8 12	75	2 4	1·25	17
„ „ meal 2% „	—	—	8 10*	0 19	7 11	71	2 1	1·12	17
Feeding treacle	—	—	6 10	0 8	6 2	51	2 5	1·29	2·7
Brewers' grains, Dried ale	—	—	8 0	0 19	7 1	49	2 11	1·56	13
„ „ „ porter	—	—	7 10	0 19	6 11	49	2 8	1·43	13
„ „ Wet ale	—	—	0 16	0 7	0 9	15	0 7	0·31	4·8
„ „ „ porter	—	—	0 12	0 7	0 5	15	0 4	0·19	4·8
Malt culms	—	—	6 10‖	1 8	5 2	43	2 4	1·25	16

* At Hull. † At Liverpool. ‖ At Bristol.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of October and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £9 2s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 7d.; P_2O_5, 3s, 10d.; K_2O, 3s. 0d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	10 8
Maize	81	6·8	8 3
Decorticated ground nut cake	73	41·0	11 10
„ cotton cake	71	34·0	10 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·44 shillings, and per unit protein equivalent, 1·51 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1927, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 10
Oats	60	7·6	7 18
Barley	71	6·2	9 3
Potatoes	18	0·6	2 5
Swedes	7	0·7	0 18
Mangolds	7	0·4	0 18
Beans	66	20·0	9 11
Good meadow hay	31	4·6	4 2
Good oat straw	17	0·9	2 3
Good clover hay	32	7·0	4 9
Vetch and oat silage	13	1·6	1 14
Barley straw	19	0·7	2 7
Wheat straw	11	0·1	1 7
Bean straw	19	1·7	2 9

* * * * * *

MISCELLANEOUS NOTES

Research Scholarships, Agricultural Scholarships, and International Conference Grants

THE following awards have been made by the Ministry on the recommendations of the Development Commissioners' Advisory Committee on Agricultural Science :—

(1) AGRICULTURAL RESEARCH SCHOLARSHIPS :

Name	*Subject of Study*
J. M. Bannerman	Economics
G. W. Chapman	Soil Chemistry
A. C. Fraser	Veterinary Science
D. E. Fraser	Animal Nutrition
E. W. Russell	Soil Chemistry
B. A. Southgate	Animal Nutrition

(2) AGRICULTURAL SCHOLARSHIPS FOR INTENDING AGRICULTURAL ORGANIZERS, LECTURERS, ETC. :

Name	*Subject of Study*
J. B. Short	Economics
A. H. Wilson	Economics, with special reference to Small Holdings
R. H. Wynne	Economics

(3) INTERNATIONAL CONFERENCE GRANTS :

Name	*Institute*	*Conference*
R. A. Fisher	Rothamsted Experimental Station	Scientific and Technical Commission for Agricultural Statistics, Rome
J. Hammond	Animal Nutrition Research Institute, Cambridge	International Congress in Genetics, Berlin
M. S. Pease	Small Animal Breeding Research Institute, Cambridge	do.

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Production of Home-Grown Beet Sugar

ACCORDING to returns rendered to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during October, 1927, together with the quantity produced during the corresponding month in 1926, was as follows :—

	Number of factories operating	Quantity of home-grown beet sugar manufactured cwt.
1927	15*	715,098
1926	12†	583,929

* Four factories had not commenced working in October, 1927.

† Two „ „ „ „ „ 1926.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended September, 1927, compared with the corresponding period in 1926. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	July to September, 1927		July to September, 1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	28	7,233	55	7,737
Brazil	14	2,785	72	4,838
Costa Rica	11	373	7	165
Colombia	14	1,229	0	0
Uruguay	13	1,210	9	1,020
Belgium	30	670	0	0
Irish Free State	702	10,221	1,087	14,556
Canada	134	10,300	0	0
Union of South Africa	45	3,839	0	0
Southern Rhodesia	22	875	0	0
South-West Africa	15	580	0	0
Other countries	16	1,001	31	2,592
Total	1,044	40,316	1,261	30,908
SHEEP AND LAMBS				
Argentina	185	4,717	157	3,883
Peru	50	625	0	0
Chili	17	755	7	203
Uruguay	40	1,340	70	2,664
United States of America	59	1,052	0	0
Irish Free State	1,195	3,279	357	1,085
Canada	326	5,190	0	0
Union of South Africa	40	428	0	0
South-West Africa	50	600	0	0
Other countries	23	812	31	599
Total	1,985	18,798	622	8,434
SWINE				
Argentina	9	245	9	140
Belgium	2	40	2	35
Poland	4	250	4	230
Germany	9	234	4	124
Latvia	15	238	1	32
France	31	232	3	68
Irish Free State	421	787	232	1,356
Union of South Africa	10	259	0	0
Falkland Islands	22	77	0	0
Other countries	8	241	37	842
Total	531	2,603	292	2,827

Demonstrations in Marketing Home Produce

London Dairy Show.—A demonstration was staged at the London Dairy Show from October 18-21, dealing with the marketing of eggs and poultry and of pigs and pig products. This demonstration was well attended and proved very successful.

Marketing of Potatoes.—The marketing of potatoes was demonstrated for the first time at the Holland (Lincs) County Potato Show at Spalding, on October 27. This demonstration was repeated at the Durham Potato Show on November 2, and at the York Potato Show, Doncaster, on November 8. In every case it attracted a large number of visitors and aroused a considerable amount of interest and discussion among local growers and merchants.

The demonstration illustrates the methods of dressing and packing main crops and earlies, both home and imported, and puts forward certain suggestions for improvement at different points. At the various shows, most interest appeared to be aroused by that part of the exhibit which draws attention to the present systems of marketing main crop potatoes, and particularly to the lack of any precise trade definition for marketable ware potatoes.

Since standardization is the key to commercial success in marketing many other products, its application to potatoes is suggested. By way of illustrating the principle involved, the Ministry, at each demonstration, put forward for consideration certain suggested standard grades for household ware potatoes. Size having been taken as the basis, the following standard grade sizes were proposed, *viz.*: for Grade A 1 a minimum of $1\frac{3}{4}$ in., for Grade A $1\frac{5}{8}$ in., and for Grade B $1\frac{1}{2}$ in., with a maximum in each case of $3\frac{1}{4}$ in. The following tolerances were also suggested as suitable for application to all grades of potatoes, *viz.*:—

(*a*) Earth and extraneous matter, a maximum of 2 per cent.
(*b*) Diseased and damaged potatoes, 3 per cent.
(*c*) Under- or over-sized potatoes, 5 per cent., and
(*d*) Admixture of variety, 5 per cent.

In the view of the National Federation of Fruit and Potato Trades Association, the grades put forward by the Ministry form a suitable basis for discussion between all parties concerned. At the Imperial Fruit Show in Manchester, this grading system was demonstrated on a small scale, and, at a joint meeting held there on November 3, between representatives of Liverpool and Manchester Retailer Fruiterers'

Fruit Marketing Demonstration at the Imperial Fruit Show, Manchester, showing the process of grading home-grown apples with the Cutler Grader.

A view of the Ministry's Potato Marketing Demonstration at the Holland (Lincs.) Potato Show at Spalding.

Associations, Manchester Wholesale Potato Traders, the C.W.S., and representatives from the Cheshire and Lancashire Farmers' Unions, the grades laid down by the Ministry were unanimously approved, but it was resolved, also unanimously, that the tolerances under the above headings (*a*), (*b*), and (*c*) should be altered to 3 per cent. in each case, with a maximum total defect of 6 per cent., and, in addition, a variety tolerance (*d*) of 4 per cent.

On November 8, at a joint meeting held in Doncaster, consisting of twenty representative farmers and twenty merchants, standard grading was freely discussed, and a resolution of approval passed. Here, however, the meeting resolved that the tolerances under the headings (*a*) and (*b*) should be altered to read 3 per cent., and that under (*c*) to read 4 per cent., and refer to under-size only.

It is very satisfactory to observe the amount of interest aroused in the large potato-growing districts of the country by the Ministry's new marketing demonstration, and somewhat gratifying to observe the amount of support for the principles demonstrated, and the extent of agreement on details already attained among both growers and merchants.

Imperial Fruit Show.—At the Imperial Fruit Show, which was held at Belle Vue Gardens, Manchester, from October 28 to November 5, the Empire Marketing Board took over the whole of one building and organized a most effective display of Empire fruit. As usual, the Great Britain exhibit was organized by the Ministry in collaboration with the National Farmers' Union and other national associations. On one side, there was an imposing display of choice fruit drawn from the principal fruit-growing districts of England, notably Kent, Herefordshire, Worcestershire, Essex, Norfolk and Cambridgeshire, and also a small exhibit of England's most important vegetable crop—the potato—graded in accordance with the national standards suggested by the Ministry. A striking display of tomatoes, cucumbers and hothouse fruits from the Lea Valley and Worthing districts was arranged by the British Glasshouse Produce Marketing Association. This Association was also good enough to supply the roses and chrysanthemums with which the stand was decorated. The other side of the stand was devoted to fruit products. The central feature was an illuminated tower composed of bottled fruits supplied by the Food Manufacturers' Federation, which also arranged for the exhibit of jams and preserves. A display of all-English cider was made by the National Association of Cider Makers. The

rapid development of the canning industry in England was demonstrated by the wide range of canned fruits and vegetables exhibited by the National Food Canning Council.

The Empire Marketing Board made a grant to the Imperial Fruit Show Committee for the free distribution of Empire fruit to visitors to the Show. Of this money, 45 per cent. was allocated to Great Britain (40 per cent. for fresh fruit and 5 per cent. for canned fruit); the distribution of the 22,500 samples involved was made from the Great Britain stand through the agency of the National Farmers' Union. A feature of the Empire Marketing Board display was a demonstration kitchen; and, in addition to securing representation of home produce in the general cooking demonstrations, the Ministry arranged for the chef of the First Avenue Hotel, London, to demonstrate the preparation of special potato dishes. Leaflets describing these dishes were distributed by the Ministry gratis.

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Poultry Advisory Committee

THE Poultry Advisory Committee of the Ministry of Agriculture and Fisheries has been reconstituted, and its terms of reference have been extended so as to enable it to advise the Ministry on all matters submitted to it in regard to the exercise by the Department of any powers and duties relating to the poultry industry. It will also consider means which can usefully be adopted to improve existing methods of egg and poultry production and marketing in England and Wales, make recommendations, and take such other action as seems desirable to secure the adoption of improved methods by the producers, distributors and other persons concerned.

The Chairman of the Committee is Mr. P. A. Francis, M.B.E., of the Ministry of Agriculture and Fisheries, with Mr. S. Street-Porter, of the National Poultry Council, as Vice-Chairman. Mr. A. W. Street, C.I.E., M.C., of the Ministry of Agriculture and Fisheries, has been appointed Vice-Chairman for marketing questions. In addition to five members nominated by the Minister to represent the interests of producers and distributors respectively, members have been nominated by the National Farmers' Union, the National Poultry Council, the National Federation of Dairymen's Associations, the National Federation of Retail Fruiterers, Florists and Fishmongers, the Federation of Grocers' Associations, the Incorporated Association of Retail Distributors, the British Association of Refrigeration, and other organizations. A nominee of the Railway

Clearing House has also been appointed to represent the railway companies.

The Secretary of the Committee is Mr. W. E. Walters, of the Ministry of Agriculture and Fisheries, with Mr. G. W. Thomas, of that Department, as Assistant Secretary for marketing.

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Special Research Grants

THE following special research grants for the academic year, 1927-28, have been awarded by the Ministry on the recommendation of the Development Commissioners' Advisory Committee on Agricultural Science :—

(*a*) RENEWALS.

Institution	*Subject*	*Investigator*
Bangor	Liver Rot in Sheep	R. F. Montgomerie
Bangor	Loss of Phosphates by Leaching	G. Griffith
Cambridge Botany School	Shab Disease of Lavender	C. R. Metcalfe
Cambridge Plant Breeding Institute	Good and Bad Fields of Wheat	L. R. Doughty
East Malling	Incidence and Control of Apple Scab	M. H. Moore
Imperial College	Loose and Covered Smuts of Barley	S. Dickinson
Manchester	Slug Control	J. Wood

(*b*) NEW APPLICATIONS.

Cambridge Department of Agriculture	Publication of Paper. "The Economy of a Norfolk Fruit Farm"	
Liverpool	Cause or Causes of Deaths amongst Ewes at Lambing Time	S. H. Gaiger and K. D. Downham
Oxford Agricultural Economics Research Institute	Farm Labour Organization	W. R. Dunlop
Reading: National Institute for Research in Dairying	Calcium Chloride or Calcium Lactate as remedies for Milk Fever	W. L. Little
South-Eastern Agricultural College, Wye	Virus Disease of Hops	—

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The Agricultural Index Number

THE general level of the prices of agricultural produce during October was 40 per cent. above pre-war, and three points lower than in September, and eight points below the figure recorded a year previously. The fall in the general index figure during the month under review is attributable mainly to the lower prices obtained for fat cattle and fat pigs,

these classes of live stock having experienced a rather poor demand during recent weeks.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	42
September	59	52	61	55	55	43
October	61	50	66	53	48	40
November	63	51	66	54	48	—
December	61	55	65	54	46	—

Grain.—Wheat prices declined during October, and at 10s. 6d. per cwt. the average for the month was 7d. lower than in September, the index figure falling by six points to 42 per cent. above the level of 1911-13. A year ago wheat was 11s. 4d. per cwt. and 53 per cent. dearer than pre-war. Barley and oats, however, showed increases of 3d. and 1d. per cwt. respectively during October, and at averages of 13s. 9d. and 9s. 2d. were 62 and 33 per cent. above the base years. In the corresponding period of 1926, barley averaged 12s. 1d. per cwt., and oats 8s. 1d. per cwt., and the relative index figures stood at 42 and 17 per cent. above the pre-war level.

Live Stock.—The prices of fat cattle have continued to decline, and second quality cattle sold on average at about 41s. per live cwt. during the month under review, the index figure at 23 per cent. above pre-war being seven points below that recorded in September. Store cattle, also, were cheaper and the average fall in price was about 5s. per head with a corresponding decline of five points in the index figure to 19 per cent. above the base years. An increase in the price of dairy cattle was noticeable during October, this being the usual tendency at this season of the year, but the rise was proportionately slightly less than in the corresponding period of the base years and the index figure is one point lower at 27 per cent. above the 1911-13 level. There was a fall of ¼d. per lb., estimated dressed carcass weight, in the price of fat sheep as compared with September, while values for store sheep were

maintained at practically the same level as those ruling in the two previous months, but as a rise in prices occurred in October of the base years, the October index number for store sheep is nine points lower at 40 per cent. above pre-war. Bacon pigs averaged 8s. 9d. per 14 lb. stone and pork pigs 10s. 3d., as against 9s. 7d. and 10s. 8d. in the previous month, and at 22 per cent. and 35 per cent., respectively, above pre-war both descriptions are selling at the lowest level reached in recent years. The index number for store pigs was eight points lower at 56 per cent. above the base years 1911-13.

Dairy and Poultry Produce.—The contract prices for milk for the season 1927-28 have followed much the same course as in the previous season, the October price in most districts being about 4½d. per gallon higher than in the previous month. In the Manchester area, however, prices have not altered appreciably from those ruling during September, but on the whole the general level of prices at 57 per cent. above the base years is only three points below the level recorded in October, 1926. Butter averaged about ¾d. per lb. more in October than in September, but, as the increase was proportionate to that which occurred in October, 1911-13, the index figure remained unaltered on the month at 41 per cent. above pre-war. Cheese, also, showed a slight increase in price, but in this instance the rise was proportionately less than in the corresponding period of the base years and the index figure declined by three points to 56 per cent. above 1911-13. An increase of about 6d. per dozen in the average price of eggs brought the index figure for October to 66 per cent. above pre-war, a rise of twelve points on the month, but two points below the level of a year ago.

Other Commodities.—At 72 per cent. above the base years, potatoes were somewhat dearer than in September, when they averaged 46 per cent., but on the whole the position is not much different from that of a year ago, when potatoes were 81 per cent. dearer than pre-war. Hay prices were about 2s. 6d. per ton higher than in September, but the index figure remained unaltered at 18 per cent. above 1911-13, a small increase in values being customary at this season of the year. Apples and pears sold at comparatively low prices during October, the former realizing only about 20 per cent. more than in pre-war years. Vegetables realized about 50 per cent. more than in 1911-13, as against about 40 per cent. in September. Wool prices were practically unaltered from those ruling in September, and the index figure was unchanged at 43 per cent. above the level of the base years.

Index numbers of different commodities during recent months and in October, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	Oct.	Oct.	July	Aug.	Sept.	Oct.
Wheat	40	53	56	56	48	42
Barley	44	42	57	64	62	62
Oats	33	17	33	43	35	33
Fat cattle	48	35	30	34	30	23
Fat sheep	62	52	45	45	45	41
Bacon pigs	70	74	43	36	34	22
Pork pigs	71	81	49	43	41	35
Dairy cows	48	38	25	25	28	27
Store cattle	32	25	26	26	24	19
Store sheep	69	47	55	48	49	40
Store pigs	88	142	80	70	64	56
Eggs	90	68	31	44	54	66
Poultry	48	48	52	43	37	43
Milk	74	60	55	55	65	57
Butter	71	52	42	38	41	41
Cheese	77	30	58	57	59	56
Potatoes	53	81	61	30	46	72
Hay	1	6	6	16	18	18
Wool	46	32	40	42	43	43

* * * * * *

Grassland Conference at the Midland College

UNDER the chairmanship of Sir Daniel Hall, K.C.B., F.R.S., a Grassland Conference, which all persons interested in are cordially invited to attend, will be held at the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, on Tuesday, January 10, 1928. The proceedings will open at 10.45 a.m. with a short address by the chairman, after which Professor R. G. Stapledon, M.A., Director of the Welsh Plant Breeding Station, Aberystwyth, will read a paper on "Grasses and Grazing"; and he will be followed by Dr. J. Hanley, Professor of Agriculture, Bristol University, with a paper on "The Manuring of Grassland." At the afternoon session, papers will be read on "Grassland Problems," by Mr. J. G. Stewart, M.Sc., of the Ministry of Agriculture and Fisheries; on "Recent Developments in Grassland Management," by Mr. R. Lindsay Robb, N.D.A., late Principal of the Newton Rigg Farm School; and on "Grassland Experiments and the Feeding Value of Grass," by Mr. H. J. Page, B.Sc., late Head of the Chemical Department

at Rothamsted. The papers will be short to allow ample time for discussion. Arrangements have been made to provide luncheon (charge, 2s.) for a limited number (up to 100), also tea (charge, 1s.). Visitors may also secure board and lodging accommodation at the College for the Conference at an inclusive charge of 10s. 6d. per day by booking in advance. Particulars of, and tickets for, the Conference may be obtained on application to Dr. Thos. Milburn, the Principal of the College, which is ten minutes' walk from Kegworth Station on the L.M.S. Railway.

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The Third World's Poultry Congress

THE idea of holding an international poultry congress originated with Dr. Edward Brown some time before the year 1914, but, before plans could be completed, the Great War temporarily arrested all development in this direction. On the conclusion of hostilities, the project again came up for consideration, and it was agreed that, in view of existing conditions, the inaugural congress should be held in one of the non-belligerent countries. Accordingly, on the invitation of Her Majesty the Queen of Holland, the first Congress was held at The Hague during the summer of 1921, and three years later the second Congress took place at Barcelona, under the patronage of the King of Spain and the Prince of the Asturias, both of whom gave it their active support.

The third World's Poultry Congress, held at Ottawa in the Dominion of Canada from July 27 to August 3 this year, was attended by some 3,000 delegates representing 43 countries, and must be regarded as one of the outstanding events in the history of the industry. The Congress was organized in five sections, and considered 150 papers submitted by specialists in the several branches of research, instruction, and marketing. The Exhibition in connexion with the Congress proved an extremely popular feature, being visited by at least 140,000 persons. Apart from an extremely fine display of live birds from many countries, of which 350 were sent from this country, the Exhibition was arranged in national sections, and consisted mainly of educational and scientific exhibits. The British section comprised items illustrating diseases, breeding, and nutrition, and pictures and models relating to various phases of the industry. Some valuable pigeons and poultry belonging to His Majesty the King and H.R.H. the Prince of

Wales were also included. The exhibits displayed by the Canadian Departments of Agriculture, both Dominion and Provincial, were naturally prominent, but it is satisfactory to note that the British section also attracted much attention, and was favourably commented on by many of the delegates.

The Right Hon. Stanley Baldwin attended a special meeting of the International Association of Poultry Instructors and Investigators for the purpose of conveying the invitation of the Imperial Government to hold the next World's Poultry Congress in Great Britain. The Congress, he said, could be assured of the support of the British Government and the Ministry of Agriculture, and a cordial welcome from the numerous poultry organizations in this country. As this invitation was unanimously accepted, the next Congress will be held in Great Britain in 1930.

* * * * * *

Marking of Imported Oats and Oat Products.—The Public Inquiry into the application for an Order-in-Council under the Merchandise Marks Act, 1926, to require the marking of imported oats and oat products, will be held in Room 104, at 10 Whitehall Place, London, S.W. 1, commencing at 10.30 a.m. on Wednesday, December 14, 1927, and continuing, if necessary, at the same time on the two following days. Applications to be heard in evidence and any other communications with regard to the matter should be addressed, as early as possible, to the Secretary of the Standing Committee, Mr. H. J. Johns, 10 Whitehall Place, London, S.W. 1.

* * * * * *

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on October 25 and November 15, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding on each occasion.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying out the Committees' decisions :—

Cambridgeshire and Isle of Ely.—An Order to come into operation on November 1, fixing minimum and overtime rates of wages for male and female workers and to continue in force until October 31, 1928. The minimum rates in the case of male workers of 21 years of age and over are for horsemen, cowmen and shepherds, 37s. per week of the hours necessary for the performance of the customary duties of workers so employed, and for all other classes of male workers 30s. per week of 48 hours in winter and 50 hours in summer (instead of 51 hours in summer as at present). The overtime rates for all classes of male workers of 21 years of age and over are 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers of 18 years of age and over, the minimum rate is 5½d. per hour with overtime at 7d. per hour.

Cheshire.—An Order to come into force on November 1, continuing the operation of the existing minimum and overtime rates of wages

for male workers and minimum rates of wages for female workers until October 31, 1928. The minimum rate in the case of male workers of 21 years of age and over is 35s. per week of 54 hours, with overtime at 9d. per hour, and in the case of female workers of 18 years of age and over, 6d. per hour for all time worked.

Essex.—An Order to come into force on November 1, continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until further notice, with the amendment that the overtime rate of wages for Sunday work shall apply to all employment on Christmas Day, Boxing Day, Good Friday, Easter Monday and Whit Monday. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter, with overtime at 9d. per hour on weekdays, and 10d. per hour on Sundays and on the public holidays mentioned above. In the case of female workers of 21 years of age and over the minimum rate is 5½d. per hour for all time worked.

Oxfordshire.—An Order to come into force on October 31, continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until further notice, with the amendment that the overtime rate of wages for Sunday work for male workers shall apply to all employment on Christmas Day, Boxing Day, Good Friday, Easter Monday, Whit Monday and August Bank Holiday. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 48 hours in winter and 50 hours in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays and on the public holidays mentioned above. The minimum rate for female workers of 18 years and over is 6d. per hour for all time worked.

Warwickshire.—An Order to come into force on October 30, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until October 27, 1928. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 6d. per hour on weekdays and 7½d. per hour on Sundays.

East Riding of Yorkshire.—(*a*) An Order fixing minimum and overtime rates of wages to come into operation on November 24, when the existing rates are due to expire, and to continue in force until November 23, 1928. The minimum rates of wages for male workers are as follows: Workers of 21 years of age and over who are not boarded and lodged by their employer, 35s. per week of 52½ hours in summer and 48 hours in winter; workers who are boarded and lodged by their employer, foremen 32s. per week or £81 12s 0d. per annum, beastmen and shepherds 29s. per week or £73 19s. 0d. per annum, and waggoners 28s. per week or £71 8s. 0d. per annum. These rates are payable in respect of a week of 48 hours in winter and 52½ hours in summer, with in addition not more than 12 hours on weekdays and three hours on Sunday in attendance on cattle and horses. Lesser rates are fixed for other lads. The overtime rates of wages in the case of male workers of 21 years of age and over are 10d. per hour on weekdays and 1s. per hour on Sundays. In the case of female workers of 16 years of age and over the minimum

rate is 6d. per hour (instead of 5d. per hour as at present), with overtime at 9d. per hour (instead of 7½d. per hour as at present). (*b*) An Order fixing special differential rates of wages for overtime employment on the corn harvest of 1928. The rate in the case of male workers of 21 years of age and over who are not boarded and lodged by their employer is 1s. 3d. per hour, and in the case of foremen, beastmen, shepherds and waggoners who are boarded and lodged, 1s. per hour, with lesser rates for other lads. In the case of female workers of 16 years of age and over the overtime rate is 11d. per hour.

West Riding of Yorkshire.—An Order to come into operation on November 24 (*i.e.*, the day following that on which the existing rates are due to expire), continuing those rates until November 23, 1928. The minimum rates in question in the case of male workers remain as at present fixed, *viz.*: For workers living-in, foremen £85 16s. 0d., beastmen and shepherds £83 4s. 0d., and waggoners £78 0s. 0d. per annum, with lesser rates for lads, these wages being in respect of a week of 48 hours in winter and 52½ hours in summer, with in addition 12 hours on weekdays and three hours on Sunday in connexion with the care of and attendance upon stock. For waggoners and other horsemen, beastmen and shepherds of 21 years of age and over not living-in, 42s. per week of the same number of hours; and for other male workers of 21 years of age and over 36s. per week of 48 hours in winter and 52½ hours in summer. Overtime is payable in the case of all male workers of 18 years of age and over at 11d. per hour on weekdays and 1s. 1d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour, with overtime at 7½d. per hour.

Carmarthenshire.—An Order to come into operation on November 15, continuing (with amendments in the case of male workers of 15 to 17 years of age) the operation of the existing minimum and overtime rates of wages for male and female workers until November 14, 1928. The minimum rate in the case of male workers of 21 years of age and over is 31s. for a seven-day week of 54 hours, with overtime at 8½d. per hour, and in the case of female workers of 18 years of age and over 5d. per hour, with overtime at 6d. per hour.

Radnor and Brecon.—An Order to come into force on November 1, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until April 30, 1928. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 54 hours in summer and 48 hours in winter, with overtime at 9d. per hour, and in the case of female workers of 18 years of age and over, 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending November 15, legal proceedings were instituted against five employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Sussex ..	Battle ..	1	0	0	0	7	6	4	10	0	1
Glos. ..	Thornbury	30	0	0	3	0	0	70	0	0	4
Somerset ..	Shepton Mallet ..	2	5	0	0	19	6	13	16	3	2
Yorks N.R.	Stokesley ..	1	10	0	0	18	0	19	17	0	2
Dorset ..	Sherborne .	4	0	0	21	0	0	87	16	8	4
		£38	15	0	£26	5	0	£195	19	11	13

* * * * * *

Foot-and-Mouth Disease.—Since the report in last month's issue of the JOURNAL, fourteen outbreaks of foot-and-mouth disease have been confirmed, all of which have occurred in new areas.

A fresh centre of disease was discovered on October 31 at Broad Hinton, Swindon, Wilts, and three further cases have been confirmed in that district.

Disease was also discovered at Windsor, Berks, on November 8, and cases at Slough, Bucks, on November 11.

New centres were in addition brought to light at Totton, Southampton, and Minstead, Lyndhurst, Hants, on November 16; and fourteen further outbreaks have been confirmed in that area.

Sixty-four outbreaks in all have been confirmed since January 1 last, involving 16 counties and the slaughter of 1,931 cattle, 1,884 sheep, 1,172 pigs, and 2 goats.

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NOTICES OF BOOKS

The Care and Handling of Milk. By Harold E. Ross. Professor of Dairy Industry, New York State College of Agriculture. (London: Kegan Paul, Trench, Trübner & Co., Ltd. 1927. Pp. xv + 342. 61 illustrations. Price 18s. net.)

Increasing knowledge of the value of milk and milk products for human consumption has made the problem of providing the population of large towns with an adequate and safe supply a question of international importance. Great advance has been made, both in this country and in America, during recent years, but new problems constantly arise which can only be solved by constant study and commercial application. This book is written by a scientific dairyman possessing wide practical and teaching experience, and is a valuable contribution worthy of study by students and by those actively engaged in the production and distribution of milk and its products. Although much of the information is based on American conditions and practice the underlying principles remain the same.

The book is well illustrated, and contains throughout useful plans and data of value to practical dairymen, whilst references are made to recent original researches which have been absorbed into commercial practice in America.

Gas Storage of Fruit. By Franklin Kidd, D.Sc., Cyril West, D.Sc., and M. N. Kidd, M.A. Special Report No. 30, Food Investigation. Department of Scientific and Industrial Research. Pp. vii+87. (London: H.M. Stationery Office, Adastral House, Kingsway, London, W.C. Price, 1s. 9d. net.)

In this Report, issued by the Department of Scientific and Industrial Research, there has been set out a review of the experiments in storing

apples in an atmosphere appreciably richer than air in carbon dioxide. Normal air consists of a mixture of gases of which nitrogen (79 per cent.), oxygen (21 per cent), and carbon dioxide (0·04 per cent.) are the chief constituents. The oxygen in the air is essential for the existence of live fruits, whilst the carbon dioxide is one of the products of respiration.

It seemed, therefore, that by using an atmosphere less rich in oxygen and more rich in carbon dioxide than is air, that the activity of living fruit might be slowed down and in consequence its storage life extended. The laboratory large-storage experiments confirmed this, though these were not entirely satisfactory because of the continued changes in temperature, the excessive moisture which accumulated in the stores, and mainly because of the losses of carbon dioxide gas through the walls of the storage chambers. In some cases, diseased fruit confused the results of the experiments.

Readers of the report will be able to follow how the work proceeded—step by step—from the laboratory to the small storage chambers, and eventually to the storage of large blocks of apples in houses of commercial size. Finally, this method of gas storage is compared with cold storage in the following words: "The generalization may, therefore, be made that gas storage at 46·5° F. and cold storage in air at 34° F. are approximately equally effective in retarding ripening and in prolonging the storage life."

Dictionary of Bacteriological Equivalents.—By William Partridge. (London: Ballière, Tindall and Cox. 1927. Pp. xii + 141. Price 10s. 6d. net.)

This little book of about 140 pages measures 7¾ in. by 5½ in., and costs half a guinea. It is compiled by a Public Analyst from acknowledged sources, and runs on the same general lines as Artschwager and Smiley's *Dictionary of Botanical Equivalents* issued by the same publishers. It contains some 8,000 words or short phrases in French, German, Italian and Spanish with their equivalents in English. The words are mainly those encountered in bacteriological literature, but there are many names of chemical substances and also some connected with general micro-biology and plant pathology. A captious critic might quarrel, perhaps, with some of the English equivalents given; for instance "leaf mould disease (tomato)" is not altogether suitable for "Blattfleckenkrankheit"; again, "'fur' of a mould" hardly expresses "Myzelrasen," although mycologists do not yet seem to have found a really suitable equivalent for the word Rasen in this connexion. In our laboratories we do not take our "Leitungswasser" from a *hydrant* but from a tap, and a "Gliederzelle" is not always a zygospore. "Eingeschliffen" is not *to* grind in, and "Reifes Sporangium" means more than "sporangium containing spores." Misprints appear to be few, but "Farbdüssigkeit" should of course be "Farbflüssigkeit." The book will be found useful as supplementing ordinary dictionaries, but the author would be well advised, should a second edition be called for, to submit his proof sheets to one or two scientific men familiar with the special literature in the languages concerned, with a view to improvement in some of the English equivalents.

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NOTES FOR THE MONTH

Housing (Rural Workers) Act

It is hoped that a considerable improvement in the conditions of rural housing will be secured through this Act, which was placed upon the Statute Book at the end of 1926. There is general agreement among agriculturists as to the desirability of improving the housing conditions of rural workers, and it was in order to assist in this direction that the Housing (Rural Workers) Act was passed.

A circular (No. 756) issued by the Ministry of Health gives full information with regard to the assistance available, and a copy can be obtained from the Stationery Office, Adastral House, Kingsway, W.C. 2, or through any bookseller (price, 2d.); and the Local Authorities (usually the County Council) administering the schemes in particular districts will give intending applicants any advice or help practicable.

Any inquiries as to the assistance available in particular districts should be addressed to the County Council, but, briefly, it may be said that the Act authorizes both grants and loans for the conversion into dwellings of buildings not previously used for that purpose, and for the improvement of existing dwellings. Grants may be made, where the estimated cost of the works is not less than £50, up to two-thirds of the estimated cost, with a maximum grant of £100. Loans may be made up to a maximum of 90 per cent. of the value of the property.

Grants may be made for works of structural alteration, repair, addition, the provision of water supply, drainage or sanitary conveniences and other like works.

Conditions are attached to ensure that grants will only be made for houses occupied by agricultural workers or persons receiving similar wages, and that the rent for a period of 20 years will be maintained at the normal agricultural rent increased by 3 per cent. on the owner's share in the estimated

cost of the works. The following example will show how the Act will work :—

A cottage is let at 4s. per week and is to be enlarged or improved at an estimated cost of £150. Towards this £150 the Local Authority can make a free grant of £100 and the owner will pay the balance of £50. The owner is authorized to charge interest on his £50 at the rate of 3 per cent., which would amount to £1 10s. per annum. The rent of the cottage would therefore be increased to 4s. 7d. per week.

Assistance towards the amount contributed by the owner may also be obtained, if desired, by way of loan from the Local Authority.

Practically all the authorities responsible for the administration of the Act have now established their machinery for the operation of the Act and obtained approval of their scheme by the Minister of Health. Facilities for the improvement of houses are therefore available, and, as the Act is of a temporary character, and is due to expire in 1931, it is desirable that owners of houses who wish to obtain the advantage of the Act for their tenants should submit their proposals without delay.

* * * * * *

Production of Home-grown Beet Sugar

ACCORDING to returns rendered to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during November, 1927, together with the quantity produced during the corresponding month in 1926, was :—

	cwt.
1927	1,423,277
1926	875,713

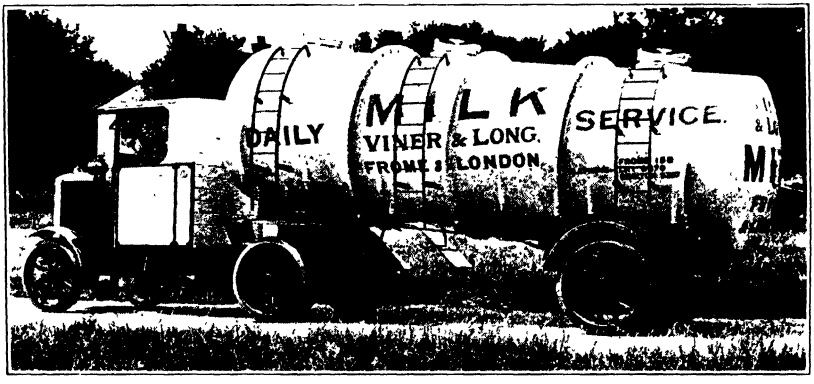
The total quantities of sugar produced during the two manufacturing campaigns to the end of November were :—

	cwt.
1927	2,138,378
1926	1,465,810

* * * * * *

Milk Transport: Clean Methods

IN recent years, unremitting attention has been devoted to the problem of ensuring a clean milk supply. While it is naturally essential that clean methods shall begin at the source of the milk—on the farm, in feeding and milking the cows, straining and cooling, etc.—it is equally necessary that devoted care shall be exercised after the milk leaves the farm. To this end, continued endeavours have been



FIGS. 1 and 2. Glass-lined tank lorries.

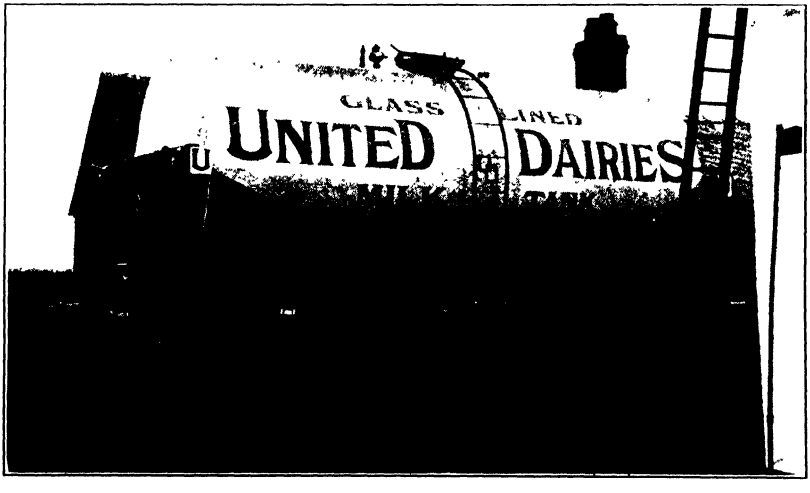


FIG. 3.—Railway glass-lined tank truck.

made for many years past to improve the conditions of transport and delivery to the consumer. Milk churns for railway transport were gradually improved so that pilfering, entry of dust, etc., could be avoided; time taken in transit has been greatly reduced; and immense improvements have taken place in the conditions under which milk is held for sale and for retail delivery.

During the last two or three years, rapid motor transport in large glass-lined tanks, holding about 1,000 gallons (see Figs. 1 and 2), has been introduced and has proved very satisfactory for distances up to about 100 miles. Farmers are able to deliver their milk to a central depot, and in these tanks, which are insulated to avoid extremes of heat and cold, the milk may then be conveyed quickly, in excellent condition, and with much less trouble to all concerned than by the usual railway milk-churn. By this means, cleanliness has been improved and bacterial count reduced considerably. (These motors were introduced by Messrs. S. Reece and Sons, Ltd., Liverpool.)

A further step, which bids fair to effect even greater improvement, is the recent extension of the tank system to railway transit. In this, the milk is delivered to a country depot, where, after cooling to about 38° F., it is passed into 3,000-gallon steel tanks, lined with glass enamel and insulated from air temperatures by a thick layer of cork. In these tanks (see Fig. 3) the milk is preserved fresh and sweet as it would be in a glass vessel, and its temperature is maintained almost constant during transit—not varying more than 1° F. The tank method also effects a great saving in dead weight haulage costs compared with ordinary milk churns—an economy, in fact, of 72·5 per cent. On arrival at destination, it is blown out by compressed and filtered air at the rate of 150 gallons per minute, pasteurized by holding at 145° F. for half an hour, rapidly cooled and passed into other tanks, from which it is automatically filled into clean, sterilized bottles, and sealed with compressed cardboard caps. The bottles are then placed in boxes and taken by roller conveyors either to closed motor lorries for delivery to various London districts or to cold store.

The successful adoption and extension of the use of tanks for the conveyance of milk would seem to depend, in no small measure, on the exercise of extreme care in the selection of the farms which are to supply the milk for filling to the tank. It can be well understood that one inferior lot of milk mixed with

a tank of, otherwise, sound milk might do a lot of harm. The use of the tank, coupled with the employment of a purchasing scheme in which provision is made for a bonus on quality, should prove a distinct step forward.

The glass-lined tanks for rail transport of milk have been introduced by the United Dairies, Ltd., and the L.M.S. and G.W. Railways have co-operated in this useful work.

* * * * * *

Walnut Survey

THE inquiry into the general character of walnuts grown in this country, instituted by the Ministry in 1924 and kindly undertaken by Mr. Howard Spence, of Ainsdale, Southport, was continued in 1926. That season, however, was unfortunately characterized by the practical failure of the home crop owing to the unfavourable weather conditions in the spring. Trees flowered well, but the crop was ruined by late frosts and high winds, and only in isolated cases did any considerable quantity of nuts mature. Of one tree which bore no crop it was reported that this was the first failure during the 30 years in respect of which records had been noted, and, in the case of many other trees from which samples had been taken for examination in previous years, failure was recorded for the first time for long periods.

The factors responsible for this failure in England also affected the crop in France, where the season was one of the worst of recent years. The Californian crop also fell below average, the production of 11,740 tons of unshelled walnuts representing only about 40 per cent. of the production in 1925.

As was only to be expected in the circumstances, the prices of walnuts in English markets were rather high, and a study of the prices reveals the interesting fact that, although generally inferior in quality, English nuts can command a much better price than nuts imported from the Continent. There is little doubt, therefore, that, with an improvement in quality, such as it is hoped to secure as a result of the present inquiry, home-grown walnuts will find a ready market.

Only 21 samples of home-grown walnuts were received for examination, about 25 per cent. of these being samples from trees reported upon in 1924–25. Under these conditions, it was hardly to be expected that much of value would be contributed to the inquiry, and no new nut showed

the combination of qualities desired, *viz.*, good colour, size, contour, percentage of kernel and of oil, flavour, sealing, crop yield, low moisture content, and absence of astringency. Repeat tests confirmed the relatively better quality previously noted in a few samples, but this was insufficiently marked to warrant propagation other than experimentally in one or two cases.

The propagating trials being carried out at East Malling Research Station have experienced a considerable set-back owing to the loss of valuable young grafted trees from the damage occasioned by severe frosts at the end of April and beginning of May, 1927. A number of the young grafted trees imported from France, however, already show some female flowers and, although it is inadvisable to allow nuts to form on young trees, a few of these will be hand-pollinated in the next year or two in order that observations of the quality of the nuts when grown under English conditions may be made as early as possible.

Graft wood obtained from Canada and the United States of America, including California, was unfortunately not so good in quality as that received in the previous year, but arrangements are being made for further supplies of scion wood to be obtained from reliable sources during the coming winter in order that the experiments in the propagation of the best foreign varieties may be extended.

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Notes on Small Holdings and Allotments

FACTS disclosed at recent meetings of the Small Holdings and Agricultural Committees for the West Riding of Yorkshire shed a very favourable light on the position of the statutory smallholders in the county. It was stated that the outstanding rents amounted to only £107 14s. 5d., which represented about 0·4 per cent. of the rent roll. The Chairman of the Agricultural Committee, in commenting on the figures, felt justified in describing the position as most satisfactory, especially in view of the losses that the tenants must have sustained as a result of the depression in agriculture in recent years. He further stated that, when inspecting the Council's estate from time to time, he seldom heard a complaint from the smallholders, who numbered about 550.

It is no doubt partly a result of the success attending the small holdings movement in this county that the demand for holdings there is so keen. Fifteen men were recently interviewed by a Sub-Committee for the purpose of selecting tenants for three vacant holdings. The Chairman of this Sub-Committee subsequently stated that these men had worked on the land all their lives, and out of their small wages they had managed to save sufficient money to enable them to take a small holding. The average amount of capital possessed by these men was about £450 and they were all described as really good-class applicants. Similar evidence is received from time to time as to the keenness of the demand for small holdings in other counties, and clearly indicates the necessity for the statutory powers conferred on county councils to enable them to satisfy the needs of suitable applicants for holdings.

Further evidence of the value of the work carried out under the powers of the Small Holdings and Allotments Acts is afforded by the success achieved by many of the tenants who have been provided with land under the Acts. The satisfactory position of the tenants of the West Riding County Council has already been commented on. One or two recent instances of the success of individual smallholders may also be mentioned. One tenant of the East Riding County Council, who in the spring of 1922 entered into occupation of an equipped holding of 20 acres, has now made application to the Council for a fully equipped holding of 50 acres which falls vacant next spring. In 1922 this man was worth £280, but to-day his assets, including £400 in the bank, are valued at £700. He has made this money mainly by retailing milk in a neighbouring seaside resort. A somewhat similar case has arisen in Derbyshire, where the tenant of a 44-acre holding has applied for permission to vacate it in order to take over the tenancy of a farm of 104 acres. This man is in a position to pay over £600 for the ingoing valuation. It may also be mentioned that numerous applications have been received by the Council for the holding which he is vacating.

An equally striking example may be quoted of the value of those provisions of the Acts which deal with allotments. The parish of Crowland in the Holland division of Lincolnshire has a population of less than 3,000, but the Parish Council has been very enterprising in an endeavour to meet the great local demand for land and has let no less than 500 acres of fen land as allotments, mostly in one-acre plots. This is a remarkable achievement in so small a parish and, moreover, has proved

a very successful venture. The allotments, which are mainly devoted to the production of potatoes and other roots, have proved a real source of wealth to the community. It is stated that the profits derived from the allotments have enabled many of the tenants to take over small holdings or to set themselves up in other small businesses. Losses through bad debts are negligible and the undertaking shows a satisfactory balance in hand.

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Demonstrations in Marketing Home Produce

THE Ministry's pig marketing demonstration was staged at the Birmingham Fat Stock Show (November 26 to December 1), the Smithfield Show, Royal Agricultural Hall, London (December 5 to 9), and the West of England Fat Stock Show, Plymouth (December 13 and 14).

The series of demonstrations of fruit grading and packing, given at various centres in the West Midlands and at the Imperial Fruit Show at Manchester in September and October, was continued by a similar demonstration at Swanley, Kent, on December 14 and 15. The principal feature of these demonstrations, and one that has attracted considerable attention, was the mechanical grading of apples by means of the Cutler grader.

The following subjects were demonstrated at the 22 shows and other centres attended during 1927 :—

Eggs	10 times
Poultry	10 times
Fruit	8 times
Pigs and Pig Products	8 times
Potatoes	3 times

It is generally agreed that a great deal of useful work has been done by means of these demonstrations. A final programme for 1928 has not yet been settled; it is, however, anticipated that it will be possible to break fresh ground during the year, as both regards the commodities dealt with and the districts visited.

At the various demonstrations, a steady demand for the Reports in the Ministry's Economic Series has been experienced —about 5,000 copies having been sold through this channel alone.

Assessment of Poultry Farms and Osier Beds to Local Rates

THE Central Valuation Committee, constituted in accordance with the provisions of the Rating and Valuation Act, 1925, for the purpose of promoting uniformity in valuation, has recently been considering the question of the entries to be made in the new valuations lists under the Act, in respect of land used for the rearing of poultry, and of osier beds.

The Ministry of Agriculture and Fisheries supplied, for the information of the Committee, a detailed description of the various kinds of buildings used for the rearing of poultry, and information descriptive of the lands used for the growing of osiers.

The Committee has now made to the Minister of Health its representations with regard to these subjects, and these have been circulated to the various rating authorities. The publication containing these representations is the third series of such representations made to the Minister of Health.*

The Committee points out that there is evidence of a diversity of opinion and of practice as to the entries to be made in the valuation lists in respect of the considerable areas of land being used for the rearing, for profit, of poultry. In some parts of the country, the land so used is being given the 75 per cent. exemption from rates which is allowable in respect of "agricultural" land, while in other parts that exemption is not being given—on the ground that the land so used is not "agricultural." A similar diversity of opinion and of practice at present exists with regard to land used for the cultivation of osiers.

With regard to land used for the rearing of poultry, the Committee recommends that, in preparing and revising the new valuation lists under the Act of 1925, all rating and assessment authorities should consider all the circumstances in which poultry are kept in arriving at a solution of the question whether the land is to be regarded as "agricultural land."

In the case of a general farm, the Committee does not think that the fact that poultry are allowed to wander over and eat the grass, insects, worms, etc., in the meadows and pastures and pick up the corn in the stubbles after harvest, takes the land out of the category of "land used as arable, meadow, or pasture ground only."

*The publication may be purchased directly from His Majesty's Stationery Office, or through any bookseller, price 2d. net.

In the case of a poultry farm proper, the Committee thinks that, in so far as it consists of grassland, it should be regarded as "pasture ground only," and that arable land should be regarded as "agricultural land" even if it is used to grow a crop for feeding poultry. The Committee is also of opinion that the presence of poultry on "allotments" and "orchards" does not prevent them from coming within the definition of "agricultural land."

On the other hand, a poultry farm proper which consists of bare land should not be held to be land used as "arable, meadow, or pasture ground only."

With regard to the question whether rateable buildings used for the rearing of poultry are buildings which, under the Act of 1925, should be given the 75 per cent. exemption from rates, the Committee draws attention to the fact that, to be eligible for this exemption, the buildings must be occupied *together with* "*agricultural land*," and must be used *solely in connexion with agricultural operations thereon*. With regard to the second part of this definition, the Committee thinks that the keeping of poultry on land is an agricultural operation thereon, but that points of difficulty may arise in connexion with the word "solely."

The Committee gives the detailed classification of poultry holdings, supplied by the Ministry, and expresses its opinion as to which types of holding should or should not be regarded as "agricultural land," and as to which types of building should or should not be regarded as coming within the definition of buildings to which the 75 per cent. exemption will apply.

With regard to the question of osier beds, the Committee recommends that, where the circumstances connected with the cultivation of osier beds are such that the lands used for the beds would necessarily have to be regarded as "arable land only" (*e.g.*, where the osiers are periodically planted and renewed, and the ground is periodically ploughed or hoed or otherwise cultivated), the rateable value of the beds should be entered in the new valuation lists under the head of "agricultural land," but that, where periodical planting and renewing and periodical cultivation are not carried on, the rateable value should be entered under the head of "Hereditaments not specified in later columns."

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EMPIRE CO-OPERATION IN AGRICULTURAL RESEARCH

W. R. BLACK, B.Sc.,
Secretary, Imperial Agricultural Research Conference.

In October and early November of 1927, there was held in this country a conference—the first of its kind—between workers conducting research in agriculture, and officers responsible for the administration of such research, throughout the British Empire, the object being to secure a greater measure of co-operation between such workers and officers than had hitherto been achieved. The proposal for holding such a conference originated with the Agricultural Research Council of Great Britain in July, 1925, and the proposal received the approval of the Imperial Conference, 1926, which urged the respective Governments of the Empire to give it the fullest possible support. The Imperial Conference, 1926, recommended that the Ministry of Agriculture and Fisheries should be responsible for organizing the Conference, and this responsibility was willingly accepted by the Ministry.

Organization of Conference.—To assist the Ministry in the work of organization, the Minister, the Rt. Hon. Walter Guinness, M.P., appointed an Organizing Committee for the Conference (of which the Rt. Hon. Lord Bledisloe, Parliamentary Secretary to the Ministry, was chairman), consisting of representatives of Government Departments in the Mother Country and of the Dominions and Colonies.

The Organizing Committee were fortunate in securing the permission of the Lord Great Chamberlain to the use of the Grand Committee Room in Westminster Hall, Houses of Parliament, for the plenary sessions of the Conference, and in obtaining, from His Majesty's Office of Works, ample accommodation for the numerous Committees of the Conference. In order that the delegates might be made aware of the progress achieved in agricultural research in the Mother Country since the war, a tour of visits to research institutes in England and Wales, Scotland, and Northern Ireland was planned; the arrangements for the tour were facilitated to a remarkable degree by the readiness with which the authorities responsible for the conduct of research into agriculture and allied subjects offered their co-operation. The principal centres visited were Cambridge, Billingham, Edinburgh, Aberdeen, Belfast, and Oxford. Offers of hospitality were received from Governments, Universities, and civic authorities in such measure that the Committee were able to arrange a very full programme of entertainment.

Acknowledgment must be made, in particular, to the Government Hospitality Fund, the Board of Agriculture for Scotland, the Government of Northern Ireland, the Universities of Cambridge, Edinburgh, Aberdeen, Belfast, and Oxford, the Lord Mayor of London, the Edinburgh Corporation, the Aberdeen Corporation, the Imperial Institute, and Synthetic Ammonia and Nitrates, Ltd. Reference must also be made to the arrangements by the L. & N.E. Railway Company for the comfort of the delegates while travelling, these including the placing of a special train at the disposal of the Conference without extra charge, the provision of meals, and co-operation in the provision of a special cinema film exhibit on the train.

The Organizing Committee also drew up an agenda which proved to be substantially that adopted by the Conference: and arranged for the collation of the material forwarded by the different Governments and the preparation of a large number of documents which it was considered would be of value to the Conference in its deliberations.

Countries and Departments Represented.—The Conference was attended by some 200 delegates and representatives. The following Dominions, Colonies, etc., were represented: Canada, Australia (Commonwealth, New South Wales, and Queensland), New Zealand, Union of South Africa, Irish Free State, Southern Rhodesia, India (and Burma, Madras and Punjab), Barbados, British Guiana, Ceylon, Cyprus, Federated Malay States and Straits Settlements (and the Rubber Research Institute of Malaya), Gambia, Gold Coast, Iraq, Kenya, Leeward Islands, Malta, Mauritius, Nigeria, Northern Rhodesia, Nyasaland, Palestine, Sierra Leone, Tanganyika (and Amani Research Institute), Trinidad (and Grenada, Windward Isles, and the Imperial College of Tropical Agriculture), Uganda, Zanzibar, and the Sudan. The following Government Departments, etc., in this country sent delegates: The Ministry of Agriculture and Fisheries (including the Royal Botanic Gardens, Kew), Dominions Office, Colonial Office, India Office, Empire Marketing Board, Development Commission, Department of Scientific and Industrial Research, Imperial Institute, Board of Agriculture for Scotland, Ministry of Agriculture for Northern Ireland, Department of Overseas Trade, Forestry Commission, Medical Research Council, Imperial Bureau of Entomology, Imperial Bureau of Mycology, Overseas Settlement Department, Board of Education, University Grants Committee, Scottish Education Department, Linen Industry Research Association, Empire Cotton-Growing Corpora-

tion, the High Commissioners for Canada, South Africa, Australia, New Zealand, Southern Rhodesia, the Irish Free State, and India, and the Agricultural Research Council of Great Britain.

The Conference was opened by the Rt. Hon. Walter Guinness, M.P., on October 4, 1927. Thereafter, the Conference appointed the Rt. Hon. Lord Bledisloe, Parliamentary Secretary to the Ministry of Agriculture and Fisheries, as chairman, and the Rt. Hon. W. G. Ormsby-Gore, M.P., Lord Lovat, and Major Elliot, M.P., vice-chairmen. The Secretariat of the Conference, under the direction of the writer and Mr. E. M. H. Lloyd, of the Empire Marketing Board, was provided by the Ministry of Agriculture and Fisheries and the Empire Marketing Board.

Message from H.M. the King.—The first act of the Conference was to send the following message of greeting to His Majesty the King :—

> "The Imperial Agricultural Research Conference, at their first meeting, desire to offer to Your Majesty an assurance of their loyal devotion and of their resolve that the present Conference shall be instrumental in promoting friendly co-operation throughout Your Majesty's Empire among all those who are engaged in the advancement of agricultural science and its application to the needs of the agricultural industry."

His Majesty's gracious reply was in the following terms :—

> "I have received your message with great pleasure. Please convey to the Conference an expression of my sincere thanks and of my interest in their work, of which I realize the great importance to the prosperity of all parts of the Empire."

Agenda.—The most important subjects in the agenda were adjudged to be those of an administrative character, *viz.* :—

(1) The Recruitment, Training and Interchange of Workers.
(2) The Establishment of a Chain of Research Stations.
(3) The Establishment of further Imperial Bureaux ; and the Interchange of Information.
(4) Periodical Conferences.

After discussion of each of these subjects by the full Conference, they were referred to an Administrative Commission which, in turn, set up three Committees to deal with them (subjects 3 and 4 being taken by one Committee). The chairmen of these three Committees were (1) Mr. F. L. Engledow, (2) Major W. Elliot, M.P., (3) Sir R. Greig.

The specialist questions, submitted to the Conference, were classified as follows, and their consideration was referred to specialist Committees with the chairmen indicated :—

A. ANIMALS.
(1) Veterinary Science (Chairman : Sir A. Theiler).
(2) Animal Nutrition (Chairman : Professor T. B. Wood).
(3) Animal Genetics (Chairman : Dr. F. A. E. Crew).
(4) Dairying (Chairman : Dr. S. S. Cameron).

B. (5) SOILS AND FERTILIZERS (Chairman : Sir John Russell).

C. PLANTS.
(6) Plant Pathology (including Mycology) (Chairman : Sir D. Prain).
(6) Plant Breeding (Chairman : Professor A. E. V. Richardson).
(8) Fruit (Chairman : Mr. W. T. Macoun).

D. (9) ENTOMOLOGY (Chairman : Dr. G. A. K. Marshall).

E. ECONOMICS.
(10) Agricultural Economics (including Marketing) (Chairman : Mr. C. S. Orwin).
(11) Preservation and Transport (Chairman : Mr. H. T. Tizard).

Thirty-three memoranda were submitted on administrative questions and 91 on specialist questions. These were grouped into 15 documents printed and stencilled, the memoranda being prefaced by précis of their contents and a general review of the objects dealt with. Various other documents were specially printed for the Conference, the chief of which were*:—

(1) A review of Agricultural Research Work in Great Britain and Northern Ireland :
(2) A review of Agricultural Research Work in the Overseas Empire ;
(3) A list of Agricultural Research Workers in the British Empire ;
(4) Abstracts of papers on Agricultural Research in Great Britain during the period October, 1926, to March, 1927.
(5) A description of an Exhibit on the History of Agricultural Literature specially prepared for the Conference by the British Museum.

The following is a very short summary of the recommendations made by the Conference.

Chain of Research Stations.—The establishment of central tropical and sub-tropical research stations should be governed primarily by the ascertained needs of Empire research in particular fields of agriculture, rather than by considerations of geographical distribution. These stations should be located in territories affording specially advantageous conditions for the study of each problem. They should in the main confine themselves to " long range " and " wide range " research.

* A limited number of copies of these are available and may be obtained from the Secretary of the Conference; the charge for No. 5 is 1s. ; the rest are free.

The work of the central research station should not impair or replace the scientific work of any Agricultural Department in its proximity. In providing advice, it should limit itself to that directly resulting from its research activities; in special conditions it might serve as a convenient base of operations for a travelling advisory staff. No teaching work should be undertaken except in so far as the advanced instruction of a limited number of post-graduate students can be undertaken with advantage to the research work in progress.

A total superior staff of some 10 highly qualified men will probably prove to be the minimum staff of a central research station. Besides adequate capital expenditure, an annual maintenance expenditure of the order of £20,000 per annum must be envisaged. If there is no reasonable prospect of such staff and funds being provided, the establishment of a station should be postponed. Contributions might be expected from both public and private sources, and, besides money, might include gifts of land and in kind.

The form of control of a central station must be such as to ensure that the work of the institution shall not be diverted from a programme of free research.

A programme of establishment of central stations was indicated by the Conference. Most of these must eventually be in the Colonial territories. So far as these territories are concerned, the development or modification of the programme is a matter primarily for the proposed Colonial Agricultural Research Council.*

The plan for a station in Northern Queensland was noted by the Conference; the establishment of further stations in the self-governing parts of the Empire must be a matter for further consideration by the Governments concerned.

The establishment of a central station for diseases of animals is of great importance, but presents difficulties. As a practical measure, an existing station should be expanded for the purpose, and such expansion of the South African Station at Onderstepoort is suggested.

The need for a central research station for irrigation problems should be further explored; and a sub-committee of the Civil Research Committee could suitably be appointed to report upon the subject in its various aspects.

* The establishment of an Agricultural Research Council to co-ordinate agricultural research in the Non Self-governing Dependencies was recommended by the Committee on Agricultural Research and Administration of the Non Self-Governing Dependencies.

Bureaux and Interchange of Information.—The functions of a clearing station should be to collect, collate and disseminate information of a scientific and technical character; to reply to inquiries on scientific and technical problems from agricultural departments and scientific workers in any part of the Empire; and, particularly, to facilitate intercourse among groups of workers on closely allied problems.

For the present, the organization of additional laboratories for attacking Imperial problems is considered to be outside these functions. Such stations are best established in conjunction with existing research institutions. They should be commenced in small numbers and on a modest scale.

The establishment of Imperial clearing stations, on the scale of bureaux, is recommended for *Soil Science* (at Rothamsted Experimental Station), *Animal Nutrition* (at Rowett Research Institute, Aberdeen), and *Animal Health* (in London). The last should include and absorb the section dealing with Animal Diseases now comprised in the Bureau of Hygiene and Tropical Diseases.

The establishment of Imperial clearing stations on a smaller scale—" correspondence centres "—is recommended for *Animal Genetics* (at the Animal Breeding Research Department, Edinburgh University), *Agricultural Parasitology* (at the Institute of Agricultural Parasitology, London School of Hygiene and Tropical Medicine), *Plant Genetics* (Cambridge Plant Breeding Institute for plants other than herbage plants, the latter to be dealt with at the Welsh Plant Breeding Station), and *Fruit Production* (at the East Malling Research Station).

The Imperial Institute and the Royal Botanic Gardens, Kew, should continue the useful work they are doing in acting as Imperial clearing stations in *Economic Botany*, and also in other directions in the case of the former Institute. As regards *Dairying*, it might be desirable to explore the best means of securing systematic collection and dissemination of information on the subject, and (in this connexion) the question of the publication of an Empire journal on dairying research. On *Preservation* and *Transport* the Low Temperature Research Station should undertake the duty of arranging for the interchange of lists of new and useful publications on those subjects. The establishment of a single publicity bureau for the Empire is not recommended, nor is a central clearing station for work other than that specified for the Imperial bureaux and correspondence centres.

The funds of the new Imperial bureaux and correspondence centres should be administered by an authority on which the Governments of the Dominions and India and certain Government Departments in the Mother Country should be represented. In addition each bureau should be advised by a technical committee nominated by the Governments concerned and reporting to the financial supervisory body; correspondence centres should, as far as practicable, also be conducted on these lines.

Uniformity in methods of indexing, recording and publication should be secured by bureaux and correspondence centres.

The sums of £13,000 for Imperial bureaux and £7,000 for correspondence centres, in all, per annum, for five years in the first instance, should be sufficient for the programme outlined.

A "List of Agricultural Workers in the Empire" prepared for the Conference should be revised and periodically circulated. A general survey of Agricultural Research in the Empire, prepared for the Conference, should be revised on the occasion of the next Conference.

The Conference will meet again in Australia in 1932. Specialist and regional conferences are desirable; the initiative in convening them should be left to the authorities immediately concerned.

Recruitment and Training.—The advance of agriculture demands that every effort should be made to attract candidates of the highest class and to equip them with the best possible training.

For the specialist officer, a sound honours training in the pure sciences, including at least one biological subject, is essential. Equally essential is such a knowledge of agriculture as will enable him to appreciate clearly the rôle of science in agriculture.

For the agricultural officer, wide agricultural knowledge, a practical outlook and administrative ability constitute the first requirements. Next come scientific knowledge adequate for the full utilization of scientific results in agriculture and for close collaboration with his specialist colleagues. Character and health are of first importance.

Recruitment for a Colonial Agricultural Service.—Adequate emoluments, facilities for work, and satisfactory superannuation arrangements are necessary in the interests of recruitment as well as for the ultimate efficiency of the Service.

The nature, amenities and prospects of the Service must be made more clearly and more widely known.

Scholarships to boys still at school are not recommended. School-leaving scholarships to the universities should be considered. Inducement in the form of scholarships of any kind is wise and fair only if the Service be made to provide really good careers. A flourishing agriculture throughout the Empire is the best guarantee of a market for Empire manufactures. It is, therefore, suggested that the founding of scholarship schemes to promote agriculture deserves the attention of all industries, agricultural and other.

The predominance of the physical sciences over the biological sciences in all educational institutions, from the elementary schools to the universities, is one of the gravest difficulties in the supply of officers for the Agricultural Service. It is essential to view this difficulty as one of education as a whole, not merely of agricultural education. The help of educational authorities should be sought without delay.

The Colonial Office Agricultural Scholarship Scheme.—The existing scheme,* strengthened and suitably modified, may be expected to meet requirements for the present, provided that it be extended to cover Veterinary Science. The scholarship scheme will be greatly facilitated if Colonial Governments supply advance warning of their staff requirements.

The Training of Colonial Office Agricultural Scholars.—The broad object of post-graduate training is to develop the scholar into the officer. Systematic training courses cannot be prescribed. It must be left to the universities and colleges to ensure that scholars have every opportunity to profit from instructional facilities and to develop themselves to the standard desired in the Service. Every possible step must be taken to free from unnecessary difficulties the share of universities in training scholars. Training should include some investigational work, and scholars should, whenever possible, be under a supervisor, himself engaged in investigation and with experience of teaching.

The training should continue to be normally one year in Great Britain and one in a tropical country, *e.g.*, at the Imperial

* The Colonial Office award annually a number of post-graduate scholarships in agriculture and agricultural science with the object of creating a pool of properly qualified candidates from which the vacancies in the Colonial Agricultural Departments can be filled. Further particulars are contained in a leaflet issued by the Ministry or may be obtained from the Private Secretary (Appointments), Colonial Office, 38, Old Queen Street, S.W.1.

College of Tropical Agriculture, Trinidad. Careful co-ordination of the work in these separate years should be effected. Short specialist courses should be avoided and soundness in fundamentals be the first aim. Provisions for training must be flexible, and the personal interest and services of the body administering the scheme for scholarships and training are the real guarantee of success.

An Imperial Basis for Recruitment and Training.—Scholarships and post-graduate training on an Imperial basis are impracticable. Scholarships and appointments to the Colonial Agricultural Service are, it is learnt with pleasure, already open, in practice, to suitable men from all parts of the Empire. The stimulation of further interest in, and recognition of, the importance of science in agricultural development should again be urged upon all the Governments of the Empire.

Study-Leave.—Facilities for study-leave are essential to the success of an agricultural service. Existing facilities are, in general, inadequate. Specific financial provision and appropriate increases in staff to make study-leave possible are an urgent necessity.

Study-leave should always have a specific object and be planned with great care for the sake of both the officer and the institution he visits. No central agency is necessary for study-leave arrangements. The bureaux and correspondence centres should be able to facilitate appropriate connexions and arrangements.

Interchange of Workers.—Routine interchange is deprecated. Beneficial interchanges will suggest themselves. Interchange would bring many benefits, some of which would reach beyond the strict limits of agricultural progress. Throughout the Empire, existing facilities are inadequate, mainly because of financial difficulties. The help of the appropriate authorities should be sought for this powerful aid to Imperial agriculture.

Veterinary Science.—The Conference afforded a unique opportunity for the exchange of ideas between veterinary science workers, from which great benefit was derived.

There is need for a clearing-house of information on this subject. Existing facilities are inadequate. A Bureau of Animal Health is proposed to deal with State veterinary hygiene and medicine, including legislative measures for the control of animal diseases. The headquarters should be in

London. It should incorporate the veterinary activities of the existing Bureau of Hygiene and Tropical Diseases.

Various concessions as regards training are made in different parts of the Empire to students of other sciences who pass over to veterinary training. Adequate specialized professional training cannot be accomplished in less than three years. Every effort should be made to encourage veterinary students to take university degrees, and undergraduate scholarships for the purpose are recommended.

Animal Nutrition.—A bureau for Animal Nutrition should be established at the Rowett Institute.

Animal Genetics.—There is need for further research in animal genetics. The work at Cambridge and Edinburgh on the physiology of reproduction should be developed ; the formation of active centres of research in animal physiology throughout the Empire should be encouraged.

Those concerned with live stock breeding and improvement should be given an understanding of genetics. Veterinary officers of the tropical and sub-tropical Colonies and the animal husbandry and live stock specialists of the Dominions should be equipped with an advanced knowledge of this subject.

The Animal Breeding Research Department of Edinburgh University should be regarded as the centre for training in animal genetics. The facilities of that department should be amplified and developed. The Colonial Office and the Governments of the Dominions and India should increase the number of post-graduate fellowships, which would enable suitable men to come to that centre. That Department should also serve as an information centre in this subject.

Dairying.—Further study is required of nutritional and breeding problems and of the physiology of milk production. Systematic investigation of the economics of dairy production is of importance. The Empire Governments should encourage the study of the problem of effecting improvements in the flavour, carrying quality, etc., of Empire dairy produce imported into Britain.

Greater uniformity should be established throughout the Empire in the official specifications prescribed for volumetric glassware used in testing milk and milk products.

The importance of interchange of dairy research workers is stressed. An Empire journal of dairy research is suggested.

Soils and Fertilizers.—There is need for a Soil Bureau, which should be located at Rothamsted Experimental Station.

Memoranda on soil classification, on principles fundamental to fertilizer trials, and on soil deterioration resulting from shifting cultivation, disafforestation, etc., have been or are being drawn up and should be passed to the new bureau for study. Methods of mechanical analysis of soil should be studied by the bureau.

Plant Breeding.—An information organization for plant breeding is recommended. The Cambridge Plant Breeding Institute is suggested as a suitable centre for crops in general, and the Welsh Plant Breeding Station for herbage plants.

Plant Pathology.—Lists of plant diseases should be prepared by Governments of the Empire. The Imperial Bureau of Mycology should publish and distribute such lists.

The attention of Empire mycologists is called to the preparation by the British Mycological Society of a list of common and scientific names of plant diseases with a view to uniformity in nomenclature. The list should be circulated to Governments.

The Imperial Bureau of Mycology should prepare a list of books and periodicals to be regarded as the minimum requirement for a Government mycologist; a copy of the list should be forwarded to departments concerned.

The Imperial Bureau of Mycology should draw up a list of institutions to whom the papers and bulletins on mycology and plant pathology published officially should be supplied by Governments.

Funds should be provided for the more extended study of the fundamental nature of virus diseases in plants.

Fruit.—The interval between the planting of fruit trees and the time when they come into bearing is so great that the losses consequent on mistakes at an early stage are extremely serious to the grower.

The most pressing questions needing research are those relating to the orchard in its early stages, the most important being: (*a*) The study of stock and scion and their inter-relations; (*b*) Surveys of fruit areas to determine the relation of various factors to tree growth and fruitfulness; (*c*) Chemical studies relating to the tree and its crop; (*d*) The associated physiological studies. A greatly extended inquiry should be undertaken, and fresh workers should be employed on these studies.

Other questions of importance are the utilization of low-grade fruit, the preservation and transport of fruit, and especially the control of diseases and pests. The provision of a suitable centre for research and advisory work on fruit preservation and by-products is urged.

Facilities should be granted for horticultural research workers in the various countries to visit other parts of the Empire.

Entomology.—At the quinquennial Imperial Conferences of entomologists each entomological service of the Empire should be represented by at least one entomologist. These conferences should occasionally be held at centres other than London. Travelling fellowships for entomologists should be established.

More attention should be paid to the biological control of insect pests. The work of the Imperial Bureau of Entomology in this direction should be further aided. More attention should be given in universities to research and teaching in pure entomology.

Insecticides and Fungicides.—A chemical investigation of insecticides and fungicides should be undertaken by chemists, working in collaboration with entomologists and plant pathologists.

Preservation and Transport.—The time is not ripe for the establishment and development of a clearing house for the interchange, throughout the Empire, of information concerning research into the preservation and transport of agricultural products. Machinery should, however, be set up at the Low Temperature Research Station for the interchange of lists of new and useful publications. It is, separately, desirable to promote the direct reference of problems, preferably by personal conference and collaboration.

All parts of the Empire should undertake the solution of fundamental problems of preservation and transport.

Scientific inspection of overseas cargoes should be carried out, on arrival in this country, by representatives of the country of origin whenever possible.

Agricultural Economics.—The importance of the study of economic conditions was stressed, as well as the need for Governments of the Empire to secure the services of whole-time agricultural economists on the staffs of their Departments of Agriculture. The attention of universities throughout the Empire should be drawn to the dearth of technically trained workers in this subject.

Interchange of information should take place on the technique of cost accounting and methods of farm surveys. Material collected by the two methods of work should serve national and inter-Imperial purposes as well as local needs.

The continuance and development of organized research in marketing, and the supply of market intelligence, is one of the most effective means of benefiting Empire agriculture.

Adequate agricultural statistics should be collected throughout the Empire. The World Agricultural Census of 1930-31 affords a unique opportunity of collecting such statistics.

Next Meeting of Conference.—During the course of the Conference, Mr. Julius, the Head of the Australian Delegation, announced that so strongly did the Government of the Commonwealth of Australia recognize the value of the contact between scientific workers and administrators in agricultural science afforded by such Conferences, that his Prime Minister, Mr. Bruce, had cordially invited the Conference, should it decide to meet periodically, to hold its next meeting in Australia. The invitation was very readily accepted by the Conference, which resolved that its next meeting should be in Australia in 1932.

Following the acceptance by the Conference of the invitation of the Prime Minister of Australia, a message was transmitted from Mr. Coates, the Prime Minister of New Zealand, by the Hon. Sir James Parr, High Commissioner for New Zealand, extending a cordial invitation to all those delegates who attend the next Conference afterwards to visit New Zealand, where they will receive a hearty welcome. Mr. Coates also stated that the New Zealand Government would co-operate with the Government of the Commonwealth of Australia in making the Conference in every way valuable and successful. This invitation was received with great pleasure by the Conference, and Lord Bledisloe, in replying to the invitation, stated that he was sure that as many as possible of the delegates to the next Conference would be most happy to include New Zealand in their itinerary.

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ROYAL COMMISSION ON LAND DRAINAGE

THE Report of the Royal Commission on Land Drainage, appointed in March last, was issued on December 7.*

As announced in the issue of this JOURNAL for April, 1927, the Commissioners, under the chairmanship of Lord Bledisloe, were directed "to inquire into the present law relating to Land Drainage in England and Wales and its administration throughout the country; to consider and report whether any amendment of the law is needed to secure an efficient system of arterial drainage without undue burdens being placed on any particular section of the community; and to make recommendations having regard to all interests concerned."

The Royal Commission examined orally 53 witnesses, including representatives from the Ministry of Agriculture and Fisheries, the Ministry of Health, the various classes of drainage authorities and local authorities, and several drainage engineers; and written evidence was presented by 111 drainage authorities. Typical drainage areas in this country were inspected, and a tour of inspection in Holland was made at the invitation of the Netherlands Government.

The evidence submitted shows that there are in England and Wales 361 drainage authorities of various types, of whom 198 operate under special Acts, and the remainder are Commissions of Sewers and elective Drainage Boards functioning under the general Land Drainage Law. In addition, there are throughout the country large numbers of small areas which, in pursuance of local Acts or the general Inclosure Acts, have been the subject of Inclosure Awards containing provisions with regard to the construction and maintenance of drainage works. Several County Councils have also obtained drainage powers under private Acts. An examination of the powers of these various bodies reveals that the administration of arterial drainage is conducted by a confused tangle of authorities established by piecemeal legislation over 500 years, and exercising a great variety of powers and functions, and that there is no uniformity of method, of powers, or of liability.

On the evidence before them, the Commissioners have arrived at the conclusion that to remove anomalies, secure reasonable uniformity, and provide for efficient administration,

* Copies of the Report (price 1s. 3d. net) can be purchased through any bookseller, or direct from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2.

it will be necessary to consolidate and amend the whole of the general law governing land drainage in this country, but two outstanding points have emerged from their investigations.

In the first place, they state that nothing has been more striking in the course of their inquiry than the revelation of the complete mutual independence of the various drainage authorities over the country. They think, therefore, that there can be no remedy for this lack of co-operation, which is largely the result of the piecemeal character of drainage legislation and the haphazard manner in which drainage authorities have been set up, short of some co-ordinating authority, in each Catchment Area where drainage works are required, exercising control over the main channel and banks of the river and working in the closest collaboration with the drainage authorities concerned with the internal drainage of the Catchment Area.

The second point of prime importance which has impressed the Commissioners is the consequence of the rule of "benefit." Under the existing law, drainage rates cannot be charged on any person who does not benefit from, or escape danger by, the drainage works in respect of which the rates are levied. The Commissioners are of opinion that, in consequence of this rule, drainage authorities have wholly inadequate areas over which they may levy rates, and that, in many instances, not only is land burdened with a drainage rate so heavy as to cripple the resources of the owner, but the amount which can be raised is so small that even essential works of maintenance cannot be efficiently carried out. The Commissioners therefore lay stress on the importance of the extension of the area of rating for the upkeep of main rivers, in order to include a much wider area than can be brought in under the existing interpretation of the principle of "benefit." They do not suggest that the doctrine of benefit should be altogether abandoned, but they are of opinion that the benefit of land drainage to any given area is not confined to the discharge of water beyond its own boundaries, but includes some responsibility for its passage to the sea. They point out that each natural river in the country is the artery which drains the lands in its Catchment Area, and that its very existence is the strongest proof of its necessity. Moreover, owing to modern conditions of roofing, paving, water supply, sanitation and so on, the waters from the uplands reach the mouth of the river much more rapidly, and in some instances in much greater volume, than they did formerly, with the result that rivers

are now called upon to discharge functions for which they were not designed by Nature.

From these two considerations, the Commissioners conclude that the Catchment Area is the proper drainage unit. Each Catchment Area, where a drainage problem exists, should be provided with a Catchment Area Authority, constituted mainly of representatives of the County and County Borough Councils in the area, which should have sole control for drainage purposes of the main channel of the river from its source. The funds required by the Authority would be raised by precept on the Councils of Counties and County Boroughs in which the Catchment Area lies, but the proportionate rate to be paid in respect of the uplands should be less than that paid in respect of the lowlands, which are the only lands at present chargeable. The Commissioners consider that the carrying out of this recommendation would impose no unfair burden on the upland districts, while it would aid materially the solution of many of the difficulties confronting drainage authorities at the present time.

The Report emphasizes the serious need for land drainage in many parts of the country. The depression in agriculture during the last 20 years of the nineteenth century made it increasingly difficult for owners of agricultural land to maintain at their own cost an efficient system of land drainage over large areas, and these difficulties have been aggravated in some parts by the scarcity of labour during the great war and its increased cost since. With the heavy fall in the prices of agricultural products and the splitting up of estates during the last few years, the serious waterlogging of land may be expected to become even more prevalent unless adequate steps are taken to ensure that drainage operations, in many cases of an extensive character, are carried out efficiently and economically. On this subject, the Report quotes some striking estimates made by the drainage engineers of the Ministry of Agriculture and Fisheries. At least 1,755,000 acres of land are in immediate need of drainage, of which 1,279,000 acres are said to suffer from flooding occasioned by defective or obstructed arterial channels, while 476,000 acres consist of land capable of improvement by means of small drainage schemes for the clearance of main ditches and other small watercourses.

The Commissioners, however, conclude their Report with a warning to the effect that, in the present condition of agriculture, it may not be possible, without State assistance,

to carry out substantial works of land drainage, and they are strongly of the opinion that, until the State is prepared to accept due financial obligations with regard to such works as the deepening and widening of main rivers and the preservation of sea walls and embankments against the excessive and violent encroachments of tidal water, very little progress can be made, even under the scheme which they have adumbrated, in the efficient drainage of agricultural land.

In addition to the proposals for the setting up of Catchment Area Authorities and for the extension of the area of rating, the Commissioners make recommendations on a number of points which, although subsidiary in character, are, nevertheless, of importance. The Report should be carefully studied by all interested in this subject.

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FRUIT AND VEGETABLE GROWING IN RHONE VALLEY

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TRAVELLING by rail southwards through France to Mentone, Cannes, Nice and other parts of the Riviera, the train enters the Rhone Valley at Lyons and follows it southwards until Marseilles is reached. In the centre is the river Rhone, at some seasons seen as a mighty rushing torrent, at others as a contracted stream of swiftly flowing waters. Smaller rivers enter the Rhone on either side—the slow and peaceful Saône at Lyons, the Doux at Tournon, and the Isère at Valence.

From the train there can be seen the grape vines in the valleys and on the hill sides, fruit plantations in the valleys and olive trees on the mountain sides; but few realize that the great area for the cultivation of early fruit and vegetables lies in the Rhone Valley or in the valleys made by its tributaries.

A day's tour in the neighbourhood of Lyons, Avignon or Toulon is sufficient, however, for the traveller to reach the little towns of Villefranche, Vienne, Chateau Rénard, Carpentras, Cavaillon, and Sollies Pont, all of which are surrounded with fields of fruit and vegetables, the land of which is cared for and tilled with the hand labour of the French peasant much as private gardens are tended in this country. The lines of tall cypress trees and reed fences, seen from the train in the regions south of Avignon, are there to break the cold winds from the Alps, lest they do damage to the tomato, melon, aubergine or

fruit crops. The canals from the rivers are taking waters to the fields where peasants use it to irrigate the crops. On the average, holdings run between two and five acres. The small-holders, though they have not yet accepted the idea of co-operative trading, have accepted the need for the existence of societies (both trading and non-trading), of which there are a number throughout the Valley.

Societies.—At Lyons is the office and headquarters of the Syndicat Agricole du Sud-Est, which is a society of 240,000 members (producers, merchants, exporters and others), formed for the development and protection of the agricultural and horticultural industry in the Sud-Est. It is a non-trading organization, but exercises an important function in development work. There are trading syndicates (associations) in the vicinity, notably one at Villefranche—" Syndicat Agricole de Villefranche et du Anse "—which buys in bulk and distributes to its members tools, manures, insecticides, fungicides and machines of all kinds. At the stores of this society were seen stacks of powder insecticides and fungicides, and a powder spraying machine, " La Sirene," which is said to be very popular. Quite a number of these trading syndicates exist, although there was not time to visit more than this one.

One gathered that the growers used insecticides and fungicides extensively—especially for the vines, and to a lesser extent for the pears and peaches, which are the next important crops.

The Plantations at Lyons.—The fruit plantations at Lyons are owned by the cultivators, and contain a mixture of grape vines, peaches (grown as bush trees), pears, and cherries, with smaller quantities of apples and red and black currants.

The freshly planted pear trees were of the espalier type, but the older ones were of a type not seen hitherto, nor in any other than the Rhone district. Of pears, the William predominated, with Beurré Hardy and Clapp's Favourite next. There were smaller quantities of Louise Bonne and Souvenir du Congrès. The B. Napoleon, B. Jaboulay, B. Pelissier, B. Blanc dur, and B. de Charmes were the chief cherries grown.

Vienne, which lies immediately south of Lyons, and the surrounding district were visited on July 20. The fruit plantations contain mixed fruits—plums (Washington, Oullins and Greengage), peaches, apricots in plenty, pears (notably Clapp's Favourite and Williams), and cherries, all closely interplanted with grape vines, these last for wine making. So closely are the trees and vines planted that all tillage work must be done by hand, necessitating a steady daily toil from

sunrise to sunset for the peasant and his family. One plantation belonging to a merchant was tilled by paid factory labour, and these people, after doing the normal eight hours in the factories, did four hours' work more per day in the plantation to augment their daily earnings. The wages for a full day's work on the land would be from 16 to 20 francs (2s. 8d. to 3s. 4d.) per day. On each cherry tree in this plantation there was a trap hanging in which a sugar bait, containing arsenical poison, had been placed during May to poison the adult flies of the Cherry Fruit Fly, which are said to feed on the sugar solutions. This form of control was noticed in other places, though fewer traps were used.

The growers at Vienne seldom consign their produce to distant markets, but sell it, without grading and proper packing, to the wholesale merchants, of whom there are a very large number resident in the town itself. A visit was paid to the premises of one merchant, and, at the time, Washington and Greengage plums, Clapp's Favourite pears, as well as peaches and apricots, were being delivered by the peasant growers into the premises. After the baskets were weighed, the fruit was turned out on to the grading table, where it was graded by hand to the special standards of this particular firm. The packing was being done by girls, and, while the individual fruits were not wrapped in paper, a really firm pack of peaches, pears, and plums was secured by using plenty of wood wool. Light and cheaply made crate or boat packages were being used, though, for some of the English markets, the "sieve" still held its own. Hand work predominated. The only machine used was a light tool for fastening the covers on to the packages with wire.

At Tain, to the south of Vienne, I visited a large and well cultivated fruit farm owned by M. Predier, formerly a solicitor. This proved to be one of the very few commercial fruit farms where hired labour (wages 20 francs per day) did most of the work. Water pipes ran through most fields, so that the land could be irrigated when necessary, or the growing fruits could be sprinkled with water to develop colour and good appearance, an operation deemed to be very important by this progressive grower. Spraying machines of the hand-pressure pump style were plentiful, and the proprietor was evidently a firm believer in the value of spraying. In the farm building, a cold-storage chamber had been installed, together with a packing shed, where girls were busy grading—not too finely—and packing peaches, pears, and apricots. These plantations contained pears,

peaches, apricots, cherries, plums, a few black currants, and some apples. Away to the south of Tain, and on to Valence, was a valley of lucerne, wheat, and mangolds, with tethered goats and oxen peacefully grazing. Tethering is necessary because no hedges or fences exist, and a stranger to the district could not discern where the boundary of each farm lay. Vines, cherries, and peaches, though never disappearing entirely, became less and less frequent south of Valence, until Avignon was reached. Here a large area on both sides of the Rhone is planted to fruit and vegetables, with perhaps Avignon, Chateau Rénard, Cavaillon, and Carpentras as the most important centres for markets.

Avignon : Irrigated Lands.—The alluvial soil in the Avignon region is very calcareous, becoming very dry during the hot summer, when the sun shines very brightly for months together; but, when this fertile land is supplied with water, good crops can be raised. Consequently, various schemes have been devised for bringing water to the fields for irrigation purposes ; and some of these systems are of long standing, for Arthur Young, in his travels in 1787-89, commented on the extended irrigation schemes used in this district, and said it was a practice not known in England. At Chateau Rénard, a canal system, constructed by a private syndicate (company), leads the waters of the Durance to the fields in the cultivated areas. The cultivators pay for the water and are allowed use during certain specified hours of the day. At Cavaillon, Carpentras, and other places, similar water companies exist for similar irrigation purposes. Where no such irrigation scheme exists, each man must construct his own irrigation system if he would have fertile land. At the small town of Aramon, where the vegetable holdings usually do not exceed two acres, each man has a system for pumping water from wells and leading it to channels between the rows of vegetables grown in every small field. At times the pumps are worked by hand, at others by horses, though, latterly, a few petrol motors, and even electric motors, have been installed. In the whole of the Avignon region, the wind from the north is strong, and it has been found necessary to provide the plants with shelter, sometimes by planting long single rows of cypress trees, or by encouraging the hedges of tall canes. Where melons, tomatoes and aubergines are grown, fences of these canes, 9 ft. high, are raised. The small vegetable farms are thus split into very tiny fields by wind breaks, and have water channels running through them in all directions.

Each district of this area yields its own special products, and is, therefore, famed for some particular crop—Cavaillon and Carpentras for asparagus and petit pois; Chateau Rénard for cherries, peaches, grapes, and pears; Aramon for cantaloup melons, cauliflowers, and salads; and Boulbon for dessert grapes, of which the variety Chasselas was said to be the choicest. Growers, no matter how small their acreage, seldom specialize in one product. Each fruit holding would contain grape vines, cherry trees, pear trees, plum trees, peach and almond trees, a few black currants, all mixed together in such a way that special spraying operations on any one kind of fruit would become extremely difficult; whilst the small vegetable farm would cultivate tomatoes, aubergines, cantaloup melons, petit pois, cauliflowers, haricot beans, salads, and new potatoes.

Street Markets.—The amount of land spared for each crop is necessarily not large, and as these vegetables mature their crops irregularly, individual growers would find a difficulty in producing sufficient bulk on any one day to engage in a really progressive marketing scheme. In practice the marketing methods adopted by the growers are very primitive, for they simply take the produce in the early hours of the morning to the towns, place the packages on the pavements in the street and then make their bargains direct with the wholesale merchants for cash. The towns at these market hours are very active. Carts line the streets, made shady with rows of plane trees (*Platanus orientalis*); whilst the packages of produce almost cover the pavements. The growers stand by their packages and conduct their bargaining with the town merchants, who alone know the best market for each package and its probable value. The street market at Avignon is held every day of the week (Sunday included), and selling may begin when the bell rings at 6 a.m., though the produce usually arrives much earlier. At Chateau Rénard, Cavaillon, and Carpentras, and all the other places, similar street markets exist, although the daily selling time varies with each district and may be as early as 4 a.m.

Topping of packages is not allowed, and where it is thought this has been done the buyers may call in the market overseer, who has sole power to fix the fresh price for the produce, his verdict being binding on both buyer and seller. The wholesale merchants pay cash for their purchases. The packages, when sold, are removed to packing stations in the towns, where the contents are emptied on to the tables, are graded, and finally

packed into the wooden crates and boat packages so commonly used by the French. The produce is consigned by the wholesalers to markets throughout France, England, Sweden, and Germany.

East of the Rhone Valley District.—To the east of Marseilles, and not far from the naval garrison town of Toulon, I found the one and only association of growers which undertakes the selling of produce on a co-operative basis. Four hundred members have combined and employed an auctioneer "crier" to act for them in offering produce to merchants daily on the street pavements, but no co-operative grading, packing or consigning to other markets had been attempted.

The Toulon District.—Not far distant from Toulon is the famous cherry district of Sollies Pont—a district of early production and famous throughout Europe for the large and juicy Reine Hortense cherries. Cherries, peaches (Hale's Early), apricots, pears (Williams, Beurré Hardy), apples (Reinette du Canada), and figs are also largely grown. The cultivation in the orchards in this area was well done and the trees looked green and prosperous, for there was no shortage of water for irrigation purposes. The cherry trees in some of the plantations here were over grass (Kent method), a practice not often seen in the Rhone Valley, the orchards generally being cultivated clean, although in more than one instance lucerne cover cropping had been practised. This lucerne crop was not allowed to rot down to humus, as is the practice in America, but was cut for cattle fodder.

A Canning Factory.—At Sollies Pont, there exists a canning factory which packs the famous "La Fontaine" brands of peaches, cherries, apricots, pears, and petit pois. This factory is of large size, and equipped with machinery, though not of the modern automatic type used in California. It employs a large number of women, but this is not a serious matter, for wages are not high for such work in France. In this area and right through the Department of the Maritime Alps at Nice, Grasse, Cannes, and Mentone, much fruit and vegetables are bottled, canned, and even preserved as "comfits." The noted crystallized fruits of commerce—cherry, peach, prune, pear, melon, and mandarine, come from this area.

Flower Growing.—Around Toulon, narcissi are much cultivated for market, the chief variety being the "Paper White"—the earliest narcissus to appear on the London market. Eastwards at Hyères, violets (Princess of Wales) and

asparagus ferns are the chief crops, and, beyond Hyères, mimosa, roses, and border carnations. Last year the production of market blooms in the Maritime Alps Department was: violets, 10,000,000 dozen bunches; roses, 800,000 dozen bunches; mimosa, 2,900,000 dozen bunches; other flowers 1,800,000 dozen bunches.

Very large acreages of flowers are also grown for the perfume industry, which is centred round Grasse, white jasmine, orange flowers, geraniums, lavender, mint, roses (Damas), violets, tuberoses, and cassier being the most important. Growers have co-operated to some extent in the perfume industry, and there exist four societies of some importance—the Nerolium, with 1,000 members, specializing in orange blossom perfume; the Hartus, with 900 members, specializing in jasmine; the Cooparfum and the Union Floriale, each with 300 members, interested in rose, jasmin, etc. The flower industry and the perfume industry increase in size annually and are at present in a very prosperous condition.

The Agricultural Work of a Railway Company.—The Paris-Lyon-Mediterranean Railway Company, which serves the Rhone Valley, does a good deal to increase crop production in the district and to keep the varieties to the kinds in demand on the market. The company now has a special staff of technically trained agriculturists, and has undertaken measures of assistance quite unique for a European railway company. In order to develop fruit and vegetable growing in certain regions, the company made a free distribution to growers of 26,500 fruit trees, 170,000 grafts of selected grapes (Chasselas), 164,000 black currant bushes, 810,000 asparagus roots, 140,000 strawberry plants, 69,000 cuttings from artichokes, and many packets of seeds of tomatoes; and even sent experts down to demonstrate methods of grafting and planting these varieties. When the strawberry plants, of the variety "Miner," at Carpentras failed to crop satisfactorily, the company had the variety transplanted in Saône-et-Loire for a time and then redistributed the regenerated plants to the growers at Carpentras. The company takes an interest in pests that cause damage to the crops, has assisted the authorities in campaigns for the control of the olive fly, the cherry fruit fly, and vine pests, and has made grants to the Entomological Stations at Saint Genis-Laval and Menton to stimulate researches in plant pests. It has also collected products of the Rhone district and staged exhibits of them in the Hall of the Lyons Great Trade Exhibition.

Peaches in the Rhone Valley.

A mixed plantation of peaches, pears and soft fruit in the Rhone Valley.

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Beds of Cantaloup melons and rows of Aubergines. Water flows down the channels between each row. (Rhone Valley.)

Rows of tomato with water channels between the rows. (Rhone Valley.) A shelter belt on the right.

Agricultural publications are issued on any matters of real importance to the growers, or where the company wishes to inform them of the needs of foreign markets. These publications have dealt with mulberry cultivation, the control of the cherry fruit fly, the peach, corn growing, and the exportation of fresh fruits and vegetables to England. From the last interesting little booklet, it appears that London and Hull are the two great centres for distribution of French produce. The "sieve" is preferred by London salesmen to all other packages, though a non-returnable package is recommended for Hull. For both markets, the exact weight should be given, and the packing should be uniform throughout. A table is included wherein is set out the varieties of fruits and vegetables suitable for the English markets. Milner, Alphonse, and Ladette strawberries are recommended; Williams, Beurré Hardy, and Duchesse pears; greengages, Blue Rocks and Pond's Seedling plums; Mayflower and Hales' Early peaches, and the Cantaloup and La Cavaillon melons. These publications and the other assistance given must be extremely useful to the French growers and have an important influence in fostering a more progressive spirit amongst the existing cultivators and a desire for development in others.

Conclusion.—The fruit and vegetable growers of the Rhone Valley owe much to the real advantages which Nature has provided—fertile soils, an abundant water supply, and plenty of sunshine—for these all help, not only in the task of raising a crop, but in bringing it to full coloured maturity. The growers, too, own the land which they cultivate, the majority having inherited it from their fathers, and therefore have no rents or charges to pay. The labour is usually provided by the owners and their families, so that little outside expenditure is incurred. The grower's lot is a happy one, for, substantially aided by Nature, he is able to secure large crops at little expense and is quite ready to cash them at values that would be considered uneconomic by our growers in England. The industry in the Rhone Valley has been established many years, and though, no doubt, important processes of development and improvement have been made, the present peasants are in a large measure merely carrying on old-established practices of cultivation, production and marketing, year by year, without much change. The lay-out of the plantations seems to be of a less commercial type than is the case in the United States of America, in Canada or in this country; machinery is less used, and in methods of pruning and spraying

the French growers are certainly not more advanced than those of England. Refrigerated fruit stores, which have developed so much in recent years in America, Canada, and England, have hardly started in the areas of production in the Rhone Valley. Nor have the French growers made any serious alterations in their marketing methods. On the other hand, the country merchants, aware of the market demand for graded and standardized produce, have established packing stations and set up an organization capable of preparing the French produce for the market in accordance with present requirements.

In the Rhone Valley, the peasants confine their attention to production and sale of ungraded produce; they leave to private firms the initiative of working schemes of irrigation, of erecting factories for making boxes, and of building houses for grading, packing, and marketing the fruit. In effect, it may be said that the fruit industry in the Rhone Valley is working on an individual basis—each grower having his own special business which he works and develops on his own lines. In that sense, the fruit industry is worked differently from the similar industries of America and Canada, where growers have united to form very large trading associations for performing all these functions on co-operative lines.

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THE USE OF WATER-BOWLS: INFLUENCE ON MILK YIELDS

DURING the two winters 1925-26 and 1926-27, a co-ordinated experiment was carried out at certain Agricultural Colleges and Farm Institutes, to obtain information on the effect of the installation of water-bowls on the milk yield of dairy cows. During the first winter, difficulties occurred in carrying out the trials on uniform lines, and, although the general results were similar to those obtained in the second winter, it has been thought undesirable to include them in detail in this report, which is therefore confined to the 1926-27 experiment.

The centres concerned were the four Farm Institutes at Reaseheath (Cheshire), Cannington Court (Somerset), Usk (Monmouthshire), and Plumpton (East Sussex). (In the 1925-26 experiment, the Midland Agricultural College also took part, but was unable to participate in 1926-27.) Various types of water-bowls were installed at each centre, the manufacturers being Messrs. Alfred Herbert, Ltd., Messrs.

George H. Gascoigne Co., Ltd., Messrs. George W. King, Ltd., Messrs. Beatty Bros., Ltd. and Messrs. Young and Co. (Westminster), Ltd. These makers presented the water-bowls to the Institutions taking part, and the scheme of experiment was discussed with and approved by them before it was adopted. This scheme, as revised for the second winter's trials, is given hereunder. The trials were commenced on the following dates: Monmouthshire Agricultural Institute, October 4, 1926; Somerset Farm Institute, January 15, 1927; Cheshire School of Agriculture, January 16, 1927; East Sussex Farm Institute, January 23, 1927. All cows under experiment were turned out for exercise twice daily in a place where water was provided irrespective of whether they had access to water-bowls or not. At Plumpton, milking was carried out three times daily, and at the other centres twice daily.

Revised Scheme, Winter, 1926-1927.

I.—The trial shall be between two lots of cows, each lot to consist of 5 or 10 cows in varying periods of lactation, but selected so that the lots are made as even as possible in all respects. Every endeavour should be made to include only cows whose lactation will not be unduly interfered with by drying off before the conclusion of the experiment.

II.—Both lots of cows shall be fed and treated alike in all respects except that only one of the lots shall have continuous access to fresh water provided through the agency of water-bowls. Both lots shall be turned out for exercise once (or twice according to the custom of the district) each day in a place where water is provided, and these shall be the only occasions when the cows not provided with water-bowls have access to water.

III.—The trials shall extend over two periods, each of five weeks' duration, with an interval of one week between the first and second periods.

IV.—Lot I shall be supplied with water-bowls during the first period, but not during the second period, and Lot II shall be supplied with water-bowls during the second period, but not during the first period.

V.—Each trial period shall be preceded by a preliminary period of two days for the cows to become accustomed to the use of bowls.

VI.—The trials shall be conducted next winter at such periods as may be most convenient to the Institute between October 1, 1926, and May 1, 1927.

VII.—During the trial periods, a careful record shall be kept of the yield of each cow at each milking.

VIII.—The butter-fat yielded by each lot during each trial period shall be estimated once each week by "Gerber" from a composite sample composed of sub-samples drawn one from each meal's milking, and preserved with bichromate of potash, or such other preservative as will maintain the condition of the same unimpaired.

IX.—If convenient means exist for recording the weights of both lots of cows at the commencement and, at the end of each trial period, it is advisable that these weights should be taken.

X.—Careful note shall be taken throughout the trial (*a*) of the readiness or otherwise with which the cows take to the use of the bowls, (*b*) the working efficiency of the types of bowls, and (*c*) ease with which they are kept clean.

XI.—The results obtained at each centre, as well as the observations of those in local charge of each trial, shall be collected together and a joint report issued thereon.

Rationing.—The cows taking part in the trials were fed as follows :—

Wales Farm.

15lb. hay and 30lb. mangolds.
4lb. dairy cubes* for each gallon of milk.

Monmouthshire Agricultural Institution.

20lb. hay
40lb. roots
1½lb. undecorticated ground nut cake } For maintenance and first gallon.
1½lb. undecorticated ground nut cake
2lb. maize meal } For each additional gallon.

Somerset Farm Institute.

16lb. hay and 20lb. mangolds.
3½lb. concentrates for each gallon of milk. (Concentrate mixture was 1 part decorticated ground nut cake, 2 maize meal, 1 crushed oats, 2 palm kernel meal, and 1 linseed cake.)

Cheshire School of Agriculture.

Yield lb.	*Hay.* lb.	*Mangolds.* lb.	*Concentrates.* lb.
Up to 25	20	25	3½
26 ,, 30	20	25	7
31 ,, 35	18	25	10½
36 ,, 40	18	25	12
41 ,, 45	16	25	14
46 ,, 50	16	25	17½
51 ,, 55	14	25	19
55 ,, 60	14	25	21

and bran mash.

From February 10, 1927, in this case, 6lb. of hay per cow was replaced by 15lb. of silage, and the concentrate mixtures were, for January and February, 1 part decorticated cottonseed meal, 2 palm kernel cake, 2 thirds, and 2 maize gluten meal, and, for March, 1 part decorticated cottonseed meal, 2 parts palm kernel cake, 1 thirds, and 1 Indian meal.

Results.—*Milk Yield.*—The milk yields of the cows, included in the experiment, are set out in Appendices 1 and 2. Appendix 1 (p. 922) shows the total amount of milk yielded by each group of cows, with and without access to water-bowls. Appendix 2 (pp. 918-921) indicates the mean daily yield each week for each cow in the Cheshire trials, and the weekly yield for each cow in the three other trials.

* Composition : 1 part extracted soya bean meal, 1 decorticated earth nut cake or meal, 2 maize meal, 2 palm kernel meal, 2 rice meal (1 per cent. salt), and 1 malt culms (1 per cent. steamed bone flour).

Butter-fat Content.—No general conclusion can be drawn from the results. At Plumpton and Usk the results favour the bowls, whilst at Reaseheath and Cannington Court the results are against them.

Weight of Cows.—At each centre (except Plumpton, which has no cattle-weighing facilities) the weight of the cows at the beginning and end of the periods, with and without bowls, was recorded. The data so obtained are neither for nor against continuous access to water. The Cheshire results were slightly against the bowls, those in Monmouthshire were slightly in their favour, whilst, at Cannington Court, there was an almost uniform decrease in weight throughout the trials of Lot I.

Discussion of Results.—The results in terms of milk yield show that at three of the four centres some advantage was derived from the use of water-bowls, whereas at the fourth centre (Reaseheath, Cheshire) the yield was slightly less with water-bowls than without. Viewed as a whole, there was a total net increase in yield of approximately 1 per cent. when water-bowls were in use compared with the yield from the same cows watered in the ordinary way without the use of bowls.

In discussing these results, however, several important qualifying facts must be borne in mind. In the first place, it is probably true that dairy herds at Farm Institutes are watered with greater convenience and regularity than would normally be the case on many private farms ; in other words, the advantage gained from the use of water-bowls, which allow continuous access to water in the cow-stalls, may not be so marked as might be the case on ordinary farms, at any rate as far as milk yield is concerned. Further, the experiment now under review can only be regarded as an interim contribution to the solution of the question whether the use of water-bowls increases milk yield, inasmuch as it is impossible, within the scope of a single trial, to take into account all the factors, other than outside watering, which may be assumed to influence yield—such, for example, as the water-content of the ration, the stage of lactation of the cow, and the potential milk yield of the cow.

Although, therefore, the conditions of the experiment in regard to points like rationing, state of lactation, and yield of cows were so devised as to give as practical a test as was possible, it would not be fair to suggest that in all cases the influence of water-bowls on milk yield was as limited as was the case in the trials now reported. Moreover, quite apart

APPENDIX 2.

MONMOUTHSHIRE AGRICULTURAL INSTITUTION

TABLE SHOWING INDIVIDUAL RECORD (WEEKLY SUMMARY) OF EACH COW IN LB.

Index No.	Name	Period since last calving.	Group 1, on water continuously. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.	Interval of one week.	Group 1, on intermittent water supply. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.
		Weeks.													
M 1	AshtonDuchess	6	225	216	192¾	191	181	1,005¾		141¾	145½	148	142½	125	702¾
M 2	Daisy	31	194¼	178	169¼	154	150¼	845¾		147¼	150¾	142¾	136	113¼	690
M 3	Daphne ..	27	138¾	136½	119¾	120¼	109¾	624¾		109	101¼	91¾	91¼	79	472¼
M 4	Dewdrop ..	8	145½	133½	116	115	111	621		101½	96¾	98¾	98	98	493
M 5	Primrose II. ..	½	251¼	265	263	232	247¾	1,259		213¾	195¾	176¼	174¼	157½	917½
	Totals ..	..	954¾	928¾	860¾	812¼	799¾	4,356¼		713¼	690	657½	642	572¾	3,275½

Index No.	Name.	Period since last calving.	Group 2, on intermittent water supply. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.	Interval of one week.	Group 2, on water continuously. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.
		weeks.													
M 6	Lady Viola II.	6	238	207	185	174½	158½	963		181½	169¾	168¼	160¼	154½	834
M 7	Mustardseed ..	19	170	163¾	152½	150¾	153¼	790¼		139½	130½	129¾	129	123	651¾
M 8	Lady Eileen ..	25	120½	115	104¾	102¾	102½	545½		85¼	79¾	74¼	66	59	364¼
M 9	Rosemary ..	4	122¾	125¼	127¼	120¾	123½	619½		102¾	100½	107¼	104¼	94½	509
M 10	Lady Diana ..	11	166½	154¾	161¾	144¾	136¼	764		113½	110¾	107½	109	102¼	543
	Totals ..	..	817¾	765¾	731¼	693½	674	3,682¼		622½	591	587	568½	533	2,902

APPENDIX 2 (*Contd.*).

SOMERSET FARM INSTITUTE.

TABLE SHOWING INDIVIDUAL RECORD (WEEKLY SUMMARY) OF EACH COW IN LB.

Index No. of cow.	Name.	Period since last calving.	Lot 1, on water continuously. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.	Interval of one week.	Lot 1, on intermittent water supply. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.
		weeks.													
S 1	Surprise ..	19	182½	173	185¾	179	177½	897¾		180¼	177¼	174¼	170¼	151¼	853¼
S 2	Hawthorn ..	7	424	412	394¾	380½	2,023¼			339¼	331¾	307¼	287½	265	1,530¾
S 3	Dorothy ..	13	133¾	134	141¾	136¾	129½	675¼		139	130	131½	133	121¾	655¼
S 4	Ethel ..	9	142½	148¼	152½	148	143½	735		140¼	145¼	142¼	145¾	139	712½
S 5	Ellen	9	88	89½	90¾	89¾	88¾	446¾		79¼	73¼	71	72¾	73½	369¾
	Totals ..	..	970¾	957¼	982¾	948½	919½	4,778½		878	857½	826¼	809¼	750½	4,121½

Index No. of cow.	Name.	Period since last calving.	Lot 2, on intermittent water supply. 1st week.	2nd week.	3rd week.	4th week	5th week.	Total for five weeks.	Interval of one week.	Lot 2, on water continuously. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.
		weeks.													
S 6	Bluebell ..	28	145	159¾	158	155¾	142½	760¼		111¼	98	84¼	88¾	75¼	457½
S 7	Dairymaid ..	6	243¾	243	256½	236¼	224¾	1,204¼		204½	200¾	200	191¼	177¾	974½
S 8	Evelyn ..	5	171½	173¼	174⅜	175¼	160¾	855½		166⅜	154½	161	161¾	153¼	797
S 9	Damsel ..	½	179¾	198	195⅞	197	193½	964		197¼	189	185½	179¼	169	920¼
S 10	Elizabeth ..	9	89	89¾	86	89¾	86	439½		90¼	88½	88	92	89	447¾
	Totals ..	..	829	862¼	871	854	807¼	4,223½		770	730¾	718¾	713¼	664¼	3,597

APPENDIX 2 (*Contd.*).
WALES FARM, PLUMPTON.
TABLE SHOWING INDIVIDUAL RECORD (WEEKLY SUMMARY) OF EACH COW IN LB.

Index No. of cow.	Name.	Period since last calving.	Group A, on water continuously. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.	Interval of one week	Group A, on intermittent water supply. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total of five weeks.
		weeks.													
W 1	Nameless ..	6	374¼	364¼	355½	332	340¾	1,766¾		324¼	317¼	328	346¾	321¼	1,637½
W 2	Daffodil ..	2	388¾	416¼	421¼	425¾	410¼	2,062¼		410¼	404¾	410½	421½	415½	2,062½
W 3	Chervil ..	6	297¼	297¾	294¾	278	268	1,435¾		231¼	223	218	207	196¼	1,075½
W 4	Hawthorn ..	14	251½	258½	253½	257½	252¾	1,273¼		248½	241¼	233¼	237¾	235½	1,196¼
W 5	Moss Rose ..	2	227¾	221¾	238½	240¼	244¾	1,173		205¾	226¾	234¼	252	245½	1,164¼
	Totals ..	..	1,539¼	1,558¼	1,563½	1,533½	1,516½	7,711		1,420	1,413	1,424	1,465	1,414	7,136

Index No. of cow.	Name.	Period since last calving.	Group B, on intermittent water supply. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.	Interval of one week	Group B, on water continuously. 1st week.	2nd week.	3rd week.	4th week.	5th week.	Total for five weeks.
		weeks.													
W 6	Hollyhock ..	2	462½	471¾	460	459½	462	2,315¾		423¼	440¾	378½	384¾	398¼	2,025½
W 7	Mignonette ..	2	343¼	327¾	335¼	340½	334¾	1,681½		350½	342¾	328½	293¼	286½	1,601½
W 8	Rosemary ..	10	227	238¼	236½	234¾	230	1,166½		239¼	237¼	237¾	240	228¾	1,183
W 9	Wallflower ..	7	197	210¼	208	215½	221¾	1,052½		230¼	221½	221¾	219½	218¼	1,111¼
W10	Sweet Pea ..	6	293½	310½	307¾	307½	307	1,526¼		310	301½	305	278¼	282¾	1,477½
	Totals ..	..	1,523½	1,558½	1,547½	1,557¾	1,555½	7,742½		1,553¼	1,543¾	1,471½	1,415¾	1,414½	7,398¾

CHESHIRE SCHOOL OF AGRICULTURE.

TABLE SHOWING INDIVIDUAL RECORD (AVERAGE DAILY YIELD PER WEEK) OF EACH COW IN LB.

Index No. of cow	Registered No.	Period since last calving.	Group 1, on water continuously.					Interval week.	Group 1, on intermittent water supply.				
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.
		weeks.											
C 1	12	7	38·9	37·7	36·4	36·4	33·8	35·8	33·3	30·7	31·4	29·7	32·1
C 2	85	14	19·4	18·6	18·8	19·0	18·9	19·0	17·5	17·6	17·0	16·0	16·2
C 3	44	8	30·8	29·1	28·6	27·9	26·8	26·6	24·9	25·8	25·4	23·3	24·4
C 4	84	14	30·4	30·0	28·0	29·7	26·8	26·3	25·9	27·8	25·6	24·8	27·8
C 5	57	12	21·4	17·7	16·6	16·6	14·4	14·0	14·2	15·7	13·4	13·0	14·0
C 6	5	13	23·3	23·6	21·9	23·8	21·9	21·9	21·1	20·3	18·1	19·1	20·6
C 7	86	13	23·6	20·8	19·4	18·0	18·5	19·1	19·3	18·9	18·4	16·1	18·9
C 8	55	1	44·6	43·6	42·4	42·4	40·6	40·9	45·9	37·6	36·9	34·1	35·7
C 9	1	1	43·0	39·3	39·7	37·7	36·3	35·6	34·0	31·9	31·9	30·4	30·4
	Average ..		30·6	28·9	28·0	27·9	26·4	26·6	26·2	25·1	24·2	22·9	24·5

Index No. of cow.	Registered No.	Period since last calving.	Group 2, on intermittent water supply.					Interval week.	Group 2, on water continuously.				
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.
		weeks.											
C 10	48	2	41·1	39·2	35·3	31·8	28·9	31·7	28·7 *	27·7	22·6	23·9	22·0
C 11	64	14	24·5	24·4	23·6	23·8	23·4	25·6	24·4	23·8	22·3	22·1	24·3
C 12	3	3	16·3	16·0	12·8	11·2	10·7	11·9	10·5	10·3	9·3	9·5	9·3
C 13	6	13	34·8	34·9	33·5	33·4	31·7	34·0	30·6	31·3	29·7	30·4	30·4
C 14	81	14	19·5	19·4	18·3	17·6	18·2	19·9	18·2	18·2	17·4	17·9	19·3
C 15	89	12	21·2	19·1	18·8	19·1	17·1	18·5	18·2	17·1	17·1	15·6	16·8
C 16	59	1	32·5	32·5	30·4	28·6	27·3	28·0	26·8	26·0	23·5	22·0	22·1
C 17	9	8	43·0	42·7	39·0	38·8	36·0	36·6	35·1	32·3	32·9	31·1	31·8
C 18	88	12	29·3	27·6	23·9	26·0	23·4	26·7	24·8	25·1	23·4	22·3	24·6
	Average		29·1	28·4	26·2	25·6	24·1	25·9	24·1	23·5	22·0	21·6	22·3

* Cow No. 48 was visibly affected by mastitis in this week. Probably this had affected the yield for two weeks previously.

from yield, the use of water-bowls possesses decided advantages in that they save labour and give a cleaner and more wholesome supply of water than is usually available. Most types of bowls are easy to work and keep clean, and the cows take to them readily.

In the opinion of those responsible for the experiment, therefore, the installation of water-bowls is desirable, if practicable, where clean, wholesome, and sufficient water is not available when the cows are turned out to drink.

It is probable that the experiments will be continued.

APPENDIX 1.

TABLE SHOWING TOTAL YIELDS WITH AND WITHOUT WATER-BOWLS.

Monmouth Agricultural Institution (5 *cows in each group*).

	With bowls. lb.		Without bowls. lb.
Group I	4,356½	Group II	3,682½
Group II	2,902	Group I	3,275½
	7,258½		6,957¾

Net *increase* with bowls, 300½lb.

Cheshire School of Agriculture (9 *cows each group*).

	With bowls. lb.		Without bowls. lb.
Group I	8,938	Group II	8,401½
Group II	7,156¾	Group I	7,747¼
	16,094¾		16,148¾

Net *decrease* with bowls, 54lb.

Wales Farm, East Sussex (5 *cows each group*).

	With bowls. lb.		Without bowls. lb.
Group A	7,711	Group B	7,742½
Group B	7,398¾	Group A	7,136
	15,109¾		14,878½

Net *increase* with bowls, 231¼lb.

Somerset Farm Institute (5 *cows each group*).

	With bowls. lb.		Without bowls. lb.
Group I	4,778½	Group II	4,223½
Group II	3,597	Group I	4,121½
	8,375½		8,345

Net *increase* with bowls, 30½lb.
Total net increase with bowls, 508¼lb.

FURTHER EXPERIMENTS WITH TAR-DISTILLATE WASHES

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DURING recent years, various accounts [(1) to (8)]* of the action of tar-distillate washes have been published, indicating the prominence which such washes now enjoy. In 1921 (3) the first sample of Carbokrimp was brought into this country by a member of the Long Ashton staff, and small-scale trials with this sample soon proved its egg-killing powers. Since then many other trials, both on a small and large scale, have been carried out. After the first proof that this fluid actually possessed egg-killing powers, attention was concentrated on the testing of various brands [(3) and (5)]. During the course of these trials it became obvious that there were certain points arising from them on which further information was greatly needed.

It became clear, from the results obtained by various workers, that, approximately, 5 per cent. of a good wash was sufficient for the control of aphis and apple sucker under good conditions. There was not sufficient information available, however, to show the effect of higher strengths on such resistant eggs as those of capsids and winter moths, although field experiments (5) had already proved that 8 per cent. strength of wash for this purpose was distinctly better than 4 per cent. The first part of this paper therefore deals with the results of trials specifically set out to test the advantages, if any, of 10 per cent. over 8 per cent. strengths.

It was soon found, too, in working both small-scale and field trials, that factors were present which caused unexpectedly poor results. A suspicion arose that exposure after spraying was one cause of divergence from the expected results. The rainfall encountered was, obviously, a possible factor, and experiments carried out to test this point are set out in the second part of the article.

The third part deals with the time at which plums and black currants become susceptible to damage from the use of these washes. It had been found in extensive field trials that

* The figures indicate references at the end of the article.

plums, more especially damsons, had proved unexpectedly susceptible to damage, even when, from their general appearance, the trees appeared safe to spray. The results of trials instituted to obtain information on this matter are given in this part.

Field Trials.—These trials were carried out in association with the West Midland Province and the Agricultural Organizers of the following counties: Gloucester, Somerset, Wiltshire, and Worcester. The trials were distributed as follows :—

Gloucester ..	2 centres.	Wiltshire ..	2 centres.
Somerset ..	1 centre.	Worcester ..	2 centres.

Two brands of tar-distillate washes were used at 4, 8 and 10 per cent. strengths. The brands tested were Carbokrimp and Mortegg. The sprays were applied in the dormant season, during January and February.

Marking.—The system of marking employed was the same as used in 1925, and was based on an estimation made by the writers in the field. The method does not attempt to differentiate more finely than an estimated 10 per cent., but has the advantage over any quasi-statistical method in that it does not involve any errors due to preliminary sampling. All the trees in a treatment were inspected as a whole, and each treatment was marked with a number from 0 to 5 according to the following scale :—

0 = no pest present.
1 = pest very slight.
2 = „ slight.
3 = „ moderate.
4 = „ bad.
5 = „ very bad.

In cases of indecision an intermediate figure was given. All the figures were then doubled, "very bad" thus receiving 10, lesser intensities of attack being allotted corresponding smaller numbers.

The insects present were Apple Sucker, Aphis, Caterpillar, and Capsid Bug. Since all strengths of both washes, with the exception of one trial, gave complete control of Apple Sucker and Aphis, and thus supported the results of 1925, only the results for Caterpillar and Capsid Bug are tabulated.

In Table I, the results are given for the six centres. At the seventh centre, excessive rain, after the application of the washes, rendered the results unreliable. In this case, Psylla eggs hatched to a small extent, even after 10 per cent. Carbokrimp, and there was no essential difference between the result obtained by using 10 per cent. and that obtained by the use of 4 per cent.

TABLE I.

	Caterpillar (mostly Tortrix)							Capsid Bug						
	*Bf.	Bt.	L.	P.	S.	W.	Average	Bf.	Bt.	L.	P.	S.	W.	Average
Control ..	3	3	3	3	2	1	2·5	3	0	5	2	3	0	3·25
10 per cent. Mortegg ..	0	0	0	0	0	0	0	1·5	–	0·5	0	1	–	0·75
8 per cent. Mortegg ..	0	0	1	1	–	0	0·4	2	–	1	1	–	–	1·0
4 per cent. Mortegg ..	0	1	2	1	1	1	1·2	3	–	4	1	1	–	2·25
10 per cent. Carbokrimp	0	0	0	0	1	0	0·17	2	–	1	0	2	–	1·25
8 per cent. Carbokrimp	0	0	1	1	1	0	0·5	3	–	2	1	1	–	1·75
4 per cent. Carbokrimp	0	1	3	2	2	1	1·5	3	–	5	1	1	–	2·5

* Bf. = Bransford; Bt. = Bratton; L. = Lydney; P. = Pinvin; S. = Stawell; W. = Warminster.

Effect of the Different Strengths of Washes.—Owing to the variation in the figure, indicating intensity of attack on the control trees, it is impossible to compare the effect of any one strength for two different centres. The results have therefore been averaged for the two insects concerned.

4 *per cent. strength.*—Although both washes obviously had some effect, both on Caterpillar and Capsid Bug, the reduction was negligible from a practical standpoint. These results confirm the conclusion drawn from the 1925 trials (5).

8 *per cent. and* 10 *per cent. strengths.*—In all four cases, where a comparison is possible, the figures indicate an appreciable superiority in killing-power for the higher strength.

Summary.—While admitting that such figures cannot be pressed too far, in view of the small attack on the controls and the practical difficulties inherent in county field trials, the fact that the figures are in every case in favour of the 10 per cent. cannot be ignored. In endeavouring to control serious pests such as Caterpillar and, more especially, Capsid Bug, such an additional killing-power, obtained by so small an extra expense, is worth employing. A comparison between the two brands, based on the same figures, shows that, in these trials, Mortegg has maintained the slight superiority previously shown for 1925.

The Effect of Rain following the Application of Tar-Distillate Washes.—In the work on tar-distillate washes, carried on from year to year at Long Ashton, it has been found that the results were influenced not only by the different brands of wash used but, also, by some other unknown factor or factors. In the season of 1924, for instance, nearly all the brands tried gave very good results, while, in 1925, the same brands gave poor results. In some cases, it is true, this divergence was due to the fact that some brands were not up to the previous year's samples, as shown by their behaviour in field trials elsewhere ; but at least two brands were still, apparently, up to the previous year's samples. The comparative figures for 1924 and 1925 for one of the better washes may be quoted here. Thus, at a 10 per cent. strength of wash for 1924, the percentage hatch of treated aphis eggs (*A. pomi*) was 0·0 against 12·0 per cent. for 1925. At 5 per cent. the figures were ·55 against 20 ; for 2½ per cent., 3 against 37 ; and for 1 per cent. strength, 27 against 58. The season of 1924 seemed, therefore, to be far more favourable than 1925 for the action of the washes. Indeed, 1925 was so bad that all the brand tests, then being conducted at Long Ashton, proved valueless, the percentage hatches being not essentially different from the controls.

In 1926, an attempt was made to test, specially, the effect of spraying conditions in respect of exposure to rain. For this purpose small apple trees covered with aphis eggs (*A. pomi*) were potted up and sprayed with Carbokrimp at 5 per cent. and 2½ per cent. strengths. They were all thoroughly dried under cover in the insectary, where ventilation and temperature were almost the same as outside, but where they were protected from rain. After 24 hours' drying, they were submitted to various treatments, some in a very moist, cool greenhouse and some outside. One or two pots were sprayed with water before they were properly dry, these not being given the preliminary drying treatment in the insectary, and some had extra sprayings with water after they were dry, in addition to normal exposure outside. In this manner, the effects of dry warm air, average dry cool air, and a very moist cool air, on the hatching of the eggs, were tested, all of them being protected from actual rain. Table II shows the results obtained from the various treatments. The number of eggs used were not actually counted, but were estimated by a method based on the counting of six sub-multiple samples. Owing to errors thus introduced, one control figure appears as more than 100 per cent. hatch.

TABLE II.—PERCENTAGE HATCH OF *A. pomi* EGGS AFTER CARBOKRIMP.

TREATMENT	5 per cent. strength		2½ per cent. strength	
	No. of eggs	Percentage hatched	No. of eggs	Percentage hatched
Warm greenhouse ..	1,800	·4	340	11·4
Moist ,, ..	986	1·1	1,120	17·8
,, ,, ..	696	·3	394	20·0
Insectary	360	1·1	148	18·9
,, ...	853	8·1	320	17·5
Outside	546	34·1	1,600	41·8
,, ...	626	19·5	1,166	50·4
,, ...	310	24·2	606	100·0
,, ...	693	42·0	613	63·8
,, ...	320	30·0	1,413	51·6
,, ...	493	25·7	193	22·8
,, ...	673	11·9	660	61·8
,, ...	416	1·2	353	32·3
Extra spraying with water	246	50·4	306	29·1
,, ,, ,,	296	18·6	5,566	33·2
Sprayed with water before dry	646	47·3	266	53·7
,, ,, ,,	2,566	24·5	573	73·6
Control	210	108		
	103	58		
	1,337	27·4		

It is clear that those eggs which were given protection from rain hatched in much smaller numbers than those exposed to rain, whether the 5 per cent. or 2½ per cent. strength be considered. For 5 per cent. strength, the average hatch of protected eggs is 2·5 per cent. against 23·6 for the unprotected, and, for the 2½ per cent. strength, the average hatch for protected eggs is 17·1 per cent. against 53·6 for the unprotected. There seems little doubt, therefore, that the effect of protection is to increase greatly the effectiveness of the wash. The air temperature and humidity in the case of the protected plants seemed to make very little difference, though there is a suggestion that the higher temperature and drier air of the warm greenhouse caused a slight reduction in hatch at the 2½ per cent. strength. The possible influence of moisture, as distinguished from rain, seems to be ruled out by the low hatch obtained in the moist greenhouse treatment. A fairly constant relative humidity of 85 per cent. was here secured, the result tending to show that the action of the spray is not a desiccation effect.

The evidence from the measurements of rainfall occurring in the month of February, during the years 1924, 1925 and

1926, supports the view that the relative failure of the wash in the latter two years was due to washing by rain. The figures are given in Table III.

TABLE III.—RAINFALL IN INCHES IN FEBRUARY AT LONG ASHTON.

Date February	1924	1925	1926	Date February	1924	1925	1926
1	—	·26	·05	16	- -	—	·20
2	- -	·12	·05	17	-	- -	·62
3	—	—	·11	18	·07	·02	·06
4	- -	·43	·06	19	- -	·03	·02
5	- -	·07	·06	20	- -	—	·015
6	—	·18	·03	21	—	·03	·005
7	—	·01	·02	22	- -	—	·025
8	·13	·06	·01	23	-	·15	·01
9	·02	·13	-	24	·09	·33	-
10	·20	·60	—	25	—	·76	—
11	- -	·35	—	26	- -	·16	—
12	—	·04	-	27	01	·56	·05
13	- -	·12	·005	28	—	·12	—
14	—	—	·32	29	·02	—	—
15	·15	·12	·19				
Total					·69	4·65	1·91
No. of rain days					8	22	20

The treatments in all the years were given either towards the end of January or early in February, and the February rainfall therefore represents, in these cases, the rainfall most likely to affect the hatching. The differences in the wet Februarys of 1925 and 1926 are well marked, both in respect of total amounts and also of rain days.

Further evidence, supporting the view that rainfall following spraying hinders the proper action of the spray, has been obtained from two other sources. County trials in the Bristol district for 1926 gave, in certain cases, somewhat erratic results. In one case, especially, no difference could be detected in the action of two standard washes at 4, 8 and 10 per cent. strength. Even *Psylla* had hatched out to some extent following a 10 per cent. application. Inquiry revealed the fact that application had been made in showery weather.

In another case, in connexion with an experiment at Long Ashton, on the damage effect of tar-distillate washes on plums, described in the third part of this paper, Aphis had hatched out to some extent after an application of 8 per cent. strength on January 19 and February 2, and to a decidedly larger extent after an application of 6 per cent. on February 1. Various casual observations on commercial plantations also add support to this view.

Fig. 1.—Victoria.

Fig. 2.—Czar.

Fig. 3.—Prolific.

Fig. 4.—Monarch.

Condition of Buds on Plums, January 19, 1923.

To face page 928.

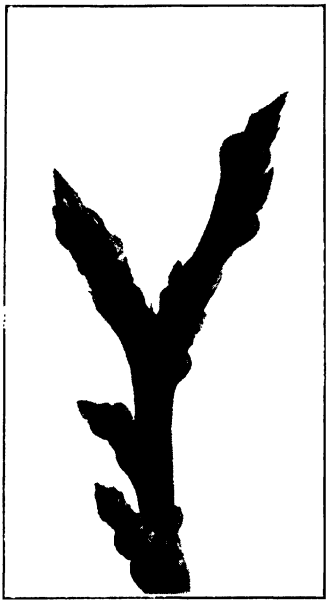

FIG. 5.—Prolific.

FIG. 6.—Monarch.

FIG. 7.—Czar.

FIG. 8.—Victoria.

Condition of Buds on Plums, February 1, 1926.

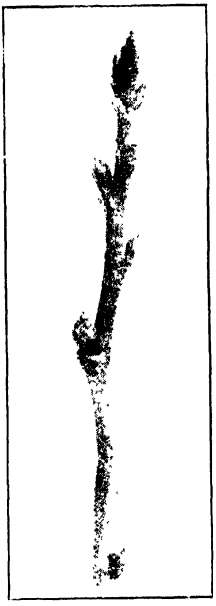

FIG. 9.—Monarch. (Feb. 11.)

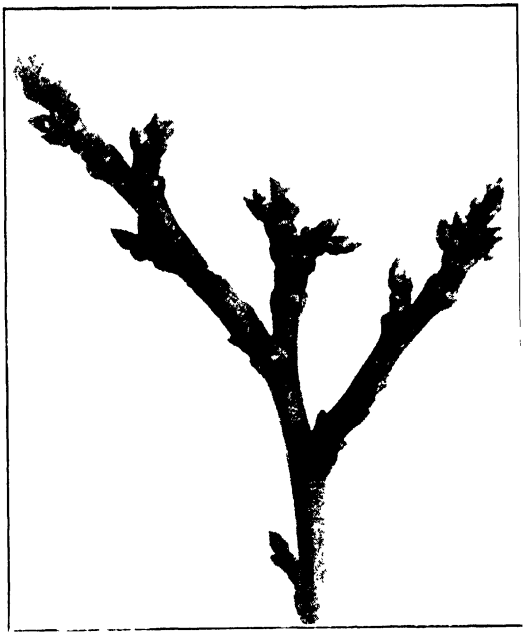

FIG. 10.—Czar. (Feb. 11.)

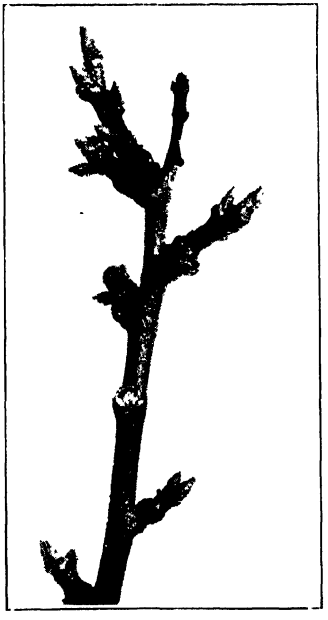

FIG. 11.—Prolific. (Feb. 11.)

FIG. 12.—Monarch. (Feb. 17.)

Condition of Buds on Plums, February 11 and 17, 1926.

FIG. 13.—Illustrating character of damage by too late application of tar-distillate wash to Plums.

Left-hand specimen sprayed during "safe" period: undamaged.
Right-hand specimen sprayed during "unsafe" period: flower buds destroyed, wood buds severely retarded.

FIG 14

FIG 15

FIG. 14.—Condition of Buds on Black Currant (Seabrook's Black), Feb. 17, 1926.

FIG. 15.—Ditto. Feb. 24, 1926.

Conclusion.—The evidence, from all sources, strongly suggests that rain following the application of a tar-distillate wash, even if dry weather follows for 24 hours, causes a lowering of the effectiveness of the wash. This action does not appear to be due to the failure of any possible desiccation effect but to the direct washing action of rain. There is no evidence yet to hand to show what period of drying is necessary for effectiveness nor how much rain can be endured with impunity. These results suggest that there is still room for improvement in tar-distillate washes in the direction of greater resistance to washing by rain, and it is hoped to initiate experiments for removing this weakness.

Time of Application in Relation to Bud Damage.—*Plums.*—Four varieties of plums were selected as suitable for testing their susceptibility to damage by tar-distillate washes. The varieties were Victoria, Czar, Monarch, and River's Early Prolific, the trees being 10 years old. The spray used was Carbokrimp, the strength being 8 per cent. One tree of each variety was sprayed on the following dates: January 19, February 1, February 11, February 19, February 24, and March 4, 1926.

The trees sprayed on February 1 were, owing to a mistake, sprayed at 6 per cent. strength. Accordingly one tree of each variety was sprayed on February 2 at the 8 per cent. strength.

A typical sample of the shoots on each tree was taken at the time of spraying and photographed. By this means a record of the state of the bud at the various times of spraying was obtained.

The amount of damage was judged by eye. Where all the flower buds were killed 10 marks were given, as in Fig. 13; where no damage was visible the number 0 was assigned. Intermediate amounts of damage were given corresponding intermediate marks.

Results.—The trees were examined for damage on March 24, 1926. The results are expressed in Table IV.

TABLE IV.—TAR-DISTILLATE SPRAY DAMAGE TO PLUMS, 1926.

	Jan. 19	Feb. 1	Feb. 2	Feb. 11	Feb. 17	Feb. 24	Mar. 4
Czar	0	0	3	7	7	7	10
Prolific ..	0	0	1	5	6	8	10
Monarch ..	0	0	1	1	7	10	10
Victoria ..	0	0	7	8	9	10	10

The condition of the buds in the four varieties at the various times of spraying is shown in Figs. 1 to 12. Spraying on January 19 with 8 per cent. strength (Figs. 1-4) produced no damage. On February 1, a 6 per cent. strength was employed by mistake and no damage followed (Figs. 5-8). On February 2, the mistake was rectified by the use of an 8 per cent. strength on four more trees, and damage followed as the result of the higher strength. It was most marked in Victoria, though the photograph taken at spraying time (Fig. 8) would strongly suggest that the stage was a safe one. Czar (Fig. 7) showed slight damage, but the buds had swollen a little at the time. Prolific and Monarch showed only a trace of damage. It is remarkable that an increase of 6 to 8 per cent. in the strength of the wash should have caused so great an increase of damage when applied at practically identical dates. On February 11, damage was serious on Czar and Prolific, but on Monarch there was still only a trace of injury. This was unexpected in view of the swollen condition of its buds when sprayed (Fig. 9).

It is clear from the above that the calendar date affords no safe guide for the time of spraying. On the other hand, this trial shows, rather unexpectedly, that the condition of the bud, as judged by the eye, also fails in this respect, though it is admittedly a more satisfactory method than the calendar date. Some other test, applicable under field conditions, would appear to be desirable.

Black Currants.—The variety of black currant used was Seabrook's Black. Four bushes were sprayed on February 11, February 17, February 24, and March 4, 1926, respectively, the strength of Carbokrimp being 10 per cent. in each case. Samples of the buds were taken and photographed as in the case of the plums. The bushes were examined on March 24, 1926.

Results.—The bush sprayed on February 17 showed no damage, while the bush sprayed on February 24 was slightly checked. It will be seen from the photographs that the bush sprayed on February 17 had buds distinctly swollen (Fig. 14), while the buds of the bush sprayed on February 24 (Fig. 15) had opened and were showing green tips.

From these trials it is clear that the variety of black currant used is highly resistant to tar-distillate washes. It must not, however, be assumed that a similar condition of bud in other varieties will, necessarily, show equal resistance to tar-distillate washes, since the tightness of bud differs considerably with the variety.

Conclusions.—(1) In field trials with Mortegg and Carbokrimp, at strengths of 4, 8 and 10 per cent., the insect eggs present being Psylla, Aphis, Tortrix, Small Winter Moth and Capsid Bug :—

(*a*) Psylla and Aphis were controlled effectively by all three strengths.

(*b*) The 10 per cent. strength for both washes gave a small but consistent improvement over the amount of control obtained by the 8 per cent. strength on Caterpillar and Capsid Bug.

(2) The effect of considerable rain following the application of 5 and 2½ per cent. Carbokrimp, after preliminary drying, was to lower the effectiveness of the spray, both in small-scale and field trials.

(3) The time at which spraying with Carbokrimp became dangerous on four varieties of plums depended :—

(*a*) On the strength employed.

(*b*) On the condition of the buds. This condition could not be determined by the calendar dates, and only to some extent by the appearance of the bud to the eye. Some other method applicable in the field was necessary.

(4) The time at which a 10 per cent. strength of Carbokrimp became dangerous to Seabrook's black currant was shown to be after the buds had already swollen distinctly.

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THE CULTIVATION OF SHALLOTS AND LEEKS

SHALLOTS.

Soil and Preparation.—Shallots are not cultivated commercially to any great extent in England, but are grown fairly extensively in gardens and allotments. They require an open site and thrive best in a well-cultivated, well-drained, rich soil containing plenty of organic manure. The soil should be dug or ploughed in the autumn or early winter, and should be left rough during the winter to allow the frost to "weather" it and to reduce it to a good friable condition before planting time arrives.

Manuring.—A dressing of farmyard manure should be applied in the autumn. This should be either ploughed in at the rate of 20-25 tons per acre (in the case of field cultivation) or dug in at the rate of three barrow-loads per square rod (for garden cultivation).

Should farmyard manure not be obtainable, the grower must rely on artificial manures, a suitable dressing of which would be 1 lb. sulphate of ammonia, 3 lb. superphosphate and 1½ lb. sulphate of potash per square rod. This dressing should be applied immediately before planting and should be raked or harrowed in. On a clay soil, the sulphate of potash could be reduced.

Planting.—Shallots can be grown from seed, but this is not the general gardening practice and is not recommended. The ordinary method of culture is to plant " bulbs " or " cloves." The best type of bulb for planting is one of fair size, conforming to type, and, above all, sound and healthy. These are planted when the soil is in an open, workable condition in February or March, the earlier the better. They can be planted much earlier provided the soil is in suitable condition.

In field cultivation, a corn drill is sometimes used for marking out the rows; the planters follow the drill and plant the bulbs in the rows thus marked out.

The rows should be 9-12 in. apart and the bulbs should be planted 6-9 in. apart in the rows. They are simply pressed into the soil by hand, leaving only the tips showing above ground.

Subsequent Cultivation.—This consists of keeping the surface soil stirred by hoeing, in order to keep down weeds and to conserve the moisture in the soil underneath.

When the young bulbs are nearly fully developed—*i.e.*, some time in June—it is advisable to draw the soil slightly away from the plants. This assists ripening.

Harvesting.—The yellowing of the leaves in July will indicate that the crop is ready for lifting. The bulbs should be pulled up by hand on a fine day and spread out in rows on the ground to ripen off. They should be left thus for several days to allow the tops to become thoroughly dried out. In gardens they may be spread out on boards or on sheets of corrugated iron to keep them off the ground if there is any risk of rain.

Storage.—Shallots should be stored in a light, dry, airy shed. They should be kept in shallow boxes if possible, but if these are not available they may safely be stored in a heap, not more than 18 in. deep, on the floor of the shed. The floor, however, must be thoroughly dry.

Shallots may be kept in this way through the winter and until the following March.

Varieties.—The two types most commonly grown are the Jersey and the Russian. The latter is a red-skinned shallot, grows to a greater size than the former, and is the more suitable for garden cultivation. The Jersey, being the smaller, is better for commercial culture for the pickle trade, which demands small bulbs.

Insect Pests.—Shallots are not very liable to attack by insect and allied pests, the only one which is responsible for any serious loss being the Onion Fly (*Phorbia cepetorum*, Meade), of which a full account is given in the Ministry's Leaflet No. 31.

The flies appear in early summer and lay their eggs on or close to the plants. The eggs give rise to maggots, which tunnel in the bulbs and destroy them. Three broods usually occur during the season. In districts where the fly is prevalent the rows should be treated with some deterrent to prevent the flies from laying their eggs in the neighbourhood of the plants.

Fungus Diseases.—Shallots may suffer from any of the diseases to which the onion is subject. The chief of these are Downy Mildew, White Rot, and Smut, fully described in the Ministry's Leaflets Nos. 178, 345 and 365 respectively. With regard to the first-named, it has recently been proved that the

mycelium of the mildew may hibernate in the bulbs. On planting such infected bulbs, the mycelium grows up into the foliage; and, under suitable weather conditions, the fungus grows out from the surface of the leaves and produces myriads of spores, which serve to spread infection to any variety of onions which may be near.

LEEKS.

Field Cultivation.—In commercial practice leeks usually follow a crop of spring cabbage or spring greens which received a heavy dressing of manure and was cleared off the land about the end of May.

Raising the Plants.—The earliest batch of plants is raised in cold frames, from seed sown in January. Plants for the main crop are raised in a seed-bed in the open from seed sown in March or April, either broadcast or in rows about 6 in. apart.

In some districts the seed is drilled in rows in the field in February or March. Where this method is practised, the seed is drilled thinly and the plants are not subsequently thinned out.

Planting Out.—When the plants in the seed-bed are about 6 in. high, they are ready for transplanting into the field. The first lot of plants from the cold frames should be ready for transplanting in May.

The plants are taken from the seed-bed, the long roots trimmed with a knife, and the tops of the leaves cut off square, leaving about 4 in. of stem. The plants should be laid neatly in flat boxes with the tops all pointing the same way, and taken to the field in the boxes for planting out. They should be planted 1-2 in. deep in holes made with a stout dibber, and in rows 12-15 in. apart, allowing 9-12 in. between the plants. In the north of England it is common to allow only 5-6 in. between the plants.

After planting, the crop should be rolled with a light flat roller to tighten the soil round the roots.

Subsequent Cultivation.—This consists of hoeing, to keep the crop free from weeds and the surface soil loose, thus conserving the moisture underneath. Horse-hoes may be used for the first hoeing, after which hand-hoes should be employed.

Manuring.—It is bad practice to give the land a dressing of farmyard manure immediately before a leek crop, and, as the leeks generally follow a crop of greens which was heavily manured in the preceding season, manure is not normally required. If, however, the crop appears to be backward, a

top-dressing of 1 cwt. nitrate of soda or sulphate of ammonia per acre will be beneficial.

Harvesting.—The first leeks should be ready for sale about the beginning of September, and lifting may be done throughout the autumn and winter as the leeks are required.

When there is a risk of the ground becoming frozen during winter, it is advisable to lift several days' supply of leeks at a time, and to protect them by a covering of leek trimmings, sacking, or other material.

In districts where the crop is grown from seed drilled in the field, instead of from transplanted seedlings, it is usual to lift alternate rows first. When these have been disposed of, the remainder of the crop is marketed.

Marketing.—Leeks are usually sent to market tied with a willow rod round the leaves, in flat fan-shaped bunches, the bunching being done in the field as the crop is lifted. At the beginning of the season, when the leeks are small, the bunches contain about twelve leeks, the number being reduced to about six as the leeks become larger. The best leeks should be placed in the centre of the bunch. After bunching, the ends of the leaves should be cut off in order to give the bunch a neat appearance. If there are any small leeks, they should be bunched in the same way and marketed as "seconds."

In some markets the demand is for washed leeks, in which case the bunches are taken to the washing shed, where they are washed free of soil. As the bunches are taken from the water they should be placed on a draining board to dry.

Varieties.—(*a*) *Early :* Giant Carentan.
(*b*) *Main Crop :* Musselburgh, Lyon.

The Musselburgh is probably the most popular variety.

Garden Cultivation.—*Soil and Preparation.*—Leeks can be grown successfully in any fertile, well-drained garden soil, but they thrive best in a fertile soil, rich in organic matter. They are often planted on land which has just been cleared of another crop, such as early potatoes or early peas, when little soil preparation is usually required, since the soil will probably be in a friable condition. It is important, however, that there should be a good depth of well cultivated soil before the seedlings are planted.

Raising the Plants.—For ordinary garden or allotment purposes the seed should be sown thinly in the row in a seed bed in the open in mild weather during March.

Planting Out.—Planting out takes place in May or June. When the seedlings are large enough to handle, the most forward may be transplanted into any available piece of ground. As more ground becomes vacant more seedlings can be taken from the row and planted out. Before taking out any plants the row of seedlings should be watered thoroughly in order to soften the ground and to permit the removal of the plants with as little damage as possible.

In transplanting, a stout dibber is used for making holes, 6 or 7 in. deep, in rows 15 in. apart, and 8 or 9 in. between the plants. The plants are simply dropped into the holes and a little soil is put in to cover the roots.

Transplanting should, if possible, be done in showery weather, but if the soil is dry it is an advantage to water the plants in.

Manures.—For the successful cultivation of leeks, it is essential that the land should be in good heart. Farmyard manure should not be applied immediately before a leek crop, nor should it be required when the leeks follow a crop of early potatoes or peas.

After the plants are established, an application of artificial manure will usually be found to give good results. This should consist of 1 lb. sulphate of ammonia or nitrate of soda per square rod, and it should be applied in two doses, the first soon after planting, and the second about a fortnight later.

On less fertile soils, this dressing should be supplemented by 3 lb. superphosphate and 1½ lb. sulphate of potash per square rod. These fertilizers should be applied to the soil before planting.

Subsequent Cultivation.—This consists chiefly of hoeing, which fills up the holes round the stems of the plants, keeps down weeds, and produces a soil mulch which conserves the moisture in the soil underneath.

As growth proceeds the soil should be drawn up lightly round the stems. This should be done in two operations, and has the effect of increasing the length of blanched stem.

Gathering the Crop.—Leeks are essentially a vegetable for use during winter. The first plants should be ready about the beginning of September, and the crop is lifted and used as required throughout the winter.

Insect Pests.—Leeks are frequently attacked by the Onion Fly (*Phorbia cepetorum*, Meade), which has at times caused serious losses. This fly appears in spring and early summer

and lays its eggs on or near the young plants. The maggots which emerge from the eggs enter the root of the plant and feed in the bulb, becoming full-grown in about three weeks. They pupate in the soil, the adult flies emerging in about seven days. There are apparently three main broods during the season.

In districts where the fly is prevalent, the crop should be planted as early as possible to obtain vigorous plants before the flies appear, as they will then be less liable to injury. The plants may also be dressed with some deterrent mixture. Formulæ for such deterrents are given in the Ministry's Leaflet No. 31, where a full account of the pest will be found.

Leeks are also attacked by the Stem Eelworm (*Tylenchus dipsaci*, Kühn), which is described in Leaflet No. 46. The leaves of the attacked plants become swollen and twisted, and the whole plant gradually rots. It is necessary to avoid growing leeks or onions for several years on land that has become infested with eelworms.

Fungus Diseases.—In the north of England, particularly, leeks are sometimes subject to attacks of Rust, caused by the fungus *Puccinia porri*. Spots, scattered or arranged more or less in rows, at first yellowish or reddish yellow, occur on the foliage. These consist of pustules of spores, and the latter, on distribution, may give rise to similar spots on healthy foliage. Later, darker coloured blackish-brown spore-pustules are developed and the spores from these are highly resistant and enable the fungus to persist over winter. The disease is difficult to control, but the removal and burning of affected leaves or plants in the early stages of attack and the avoidance of planting leeks in the same ground in successive years may be recommended where practicable.

Like onions, leeks may suffer from the so-called White Rot disease caused by *Sclerotium cepivorum*. This is fully described in the Ministry's Leaflet No. 345.

Onion Smut, due to *Urocystis cepulæ*, also attacks leeks. This serious disease is scheduled under the Destructive Insects and Pests Acts, and its occurrence in places in England and Wales must be notified immediately, either direct to the Ministry of Agriculture or to one of its Inspectors. Full particulars of the disease will be found in the Ministry's Leaflet No. 365.

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AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1927

Produce of Crops.—Preliminary statement showing the estimated total produce and yield per acre of the corn, hay and root crops in England and Wales in 1927, with comparisons for 1926, and the average yield per acre of the 10 years 1917-26, is given below.

CROPS	ESTIMATED TOTAL PRODUCE		ACREAGE		ESTIMATED YIELD PER ACRE		
	1927	1926	1927	1926	1927	1926	AVERAGE OF THE TEN YEARS, 1917–26
	000's of cwt.	000's of cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Wheat	28,455	26,073	1,635,929	1,592,207	17·4	16·4	17·2
Barley	17,246	18,326	1,048,886	1,147,647	16·4	16·0	14·8
Oats	26,874	29,807	1,750,637	1,863,452	15·3	16·0	13·7
Mixed Corn	1,633	1,761	108,328	113,510	15·1	15·5	14·3
Beans	3,263	3,166	189,864	201,703	17·2	15·7	15·4
Peas	1,011	1,064	76,815	72,699	13·2	14·6	13·8
	000's of tons	000's of tons					
Seeds Hay*	2,110	2,352	1,586,173	1,577,789	26·6	29·8	28·2
Meadow Hay†	4,157	4,771	4,317,347	4,358,355	19·3	21·9	20·8
					Tons	Tons	Tons
Potatoes	3,055	2,763	513,947	499,410	5·9	5·5	6·1
Turnips & Swedes	8,643	10,983	714,599	766,626	12·1	14·3	12·4
Mangolds	5,457	7,120	304,580	338,165	17·9	21·0	19·3

* Hay from Clover, Sainfoin, and Grasses under rotation.
† Hay from Permanent Grass.

Note.—Although the adverse weather conditions which prevailed over most of the country both prior to and during harvest impaired the quality and condition of the grain, the principal cereal crops appear to be giving better yields than was at one time anticipated. On the other hand, the yields of root crops are below average, which was to be expected in consequence of the dry conditions during the sowing period and the excessive wet and lack of sunshine during the summer and autumn months.

Corn Crops.—The yield per acre of WHEAT is estimated at 17·4 cwt., which is about 1 cwt. per acre above last year's figure, and slightly above the average of the previous 10 years. The best yields were obtained in the eastern counties, where

they are nearly ¾ cwt. above average, and over average crops were also obtained in the north-eastern and east midland counties, in the West Riding of Yorkshire and in North Wales, but over the remainder of the country yields were generally under average. The estimated total production is 28,455,000 cwt., which is 2,382,000 cwt. more than in 1926, but the area under this crop this year was 44,000 acres greater than last year.

Every division of the country, with the exception of South Wales, had over average crops of BARLEY, the best crops being obtained in the eastern, north-eastern and east midland divisions. The yield per acre for England and Wales is estimated at 16·4 cwt., this being nearly ½ cwt. per acre more than in 1926, and over 1½ cwt. in excess of the average for the ten years 1917-1926. The total production on an acreage smaller by 99,000 acres is only 17,246,000 cwt., or 1,080,000 cwt. less than last year, and is the smallest crop ever recorded.

The yield per acre of OATS is estimated at 15·3 cwt. per acre, as compared with 16·0 cwt. in 1926, and in view of the heavy reduction of 113,000 acres under this crop this year the total production of 26,874,000 cwt. is 2,933,000 cwt. below last year's total. The yield per acre is, however, nearly 1¾ cwt. above the average for the previous 10 years, practically every county having over average yields.

MIXED CORN has a yield of nearly 15·1 cwt. per acre, or about ½ cwt. below last year's yield. This is, however, ¾ cwt. above average. The total production is estimated at 1,633,000 cwt., which is 128,000 cwt. less than last year on a smaller acreage.

BEANS appear to be a better crop than previously forecasted, and the yield per acre is estimated at nearly 17¼ cwt., which is 1½ cwt. more than last year, and 1¾ cwt. above average, the total production being 3,263,000 cwt., as compared with 3,166,000 cwt. in 1926.

PEAS have not proved so satisfactory as was anticipated, and in spite of the increased area of 4,000 acres this year the estimated total production of 1,011,000 cwt. is 53,000 cwt. below the production in 1926. The yield per acre over the whole country is nearly 13¼ cwt., or a little more than ½ cwt. below average.

Hay.—Owing to the wet weather the hay harvest was unduly protracted, and comparatively little was secured in good condition, while a certain amount was never even carted.

The yield of SEEDS HAY is estimated at a little over 26½ cwt. per acre, or 1½ cwt. below average, and as much as 3¼ cwt.

per acre less than in 1926. Except in North Wales, every division of the country had under average crops. The total production of 2,110,000 tons is 242,000 tons less than the 1926 crop, notwithstanding an increased area of 8,000 acres this year.

The estimated yield per acre of MEADOW HAY is 19¼ cwt. per acre, as against an average of about 20¾ cwt. and nearly 22 cwt. last year. Nearly all English counties had under average yields, but over average yields were obtained in a number of Welsh counties. The production was 4,157,000 tons, or 614,000 tons less than in the previous year, while the total production of all hay amounted to 6,267,000 tons, and was 613,000 tons below the average of the 10 years 1917-26.

Potatoes.—The estimated yield per acre of potatoes is slightly in excess of previous forecasts, and this crop is now estimated at 5·9 tons per acre, or about 3 cwt. below average, and nearly ½ ton better than in 1926. Of the more important potato-growing counties Lancashire, Cheshire, Isle of Ely, and the Lindsey division of Lincoln had below average yields, but in the Holland division and in Essex above average yields were obtained. The total production over the whole of England and Wales is estimated at 3,055,000 tons, as compared with 2,763,000 tons in 1926, and 3,214,000 tons in 1925.

Roots.—As anticipated earlier in the year, the estimated yield per acre of TURNIPS AND SWEDES is slightly above 12 tons, or about ⅓ ton below average, and 2¼ tons less than in 1926. Over the whole country the yield of this crop is very variable, Wiltshire being over 3 tons per acre above average, while Yorkshire (North Riding) and Cumberland are respectively 3½ and 4¼ tons below average. The total production is 8,643,000 tons, or 2,340,000 tons less than in 1926.

MANGOLDS are also a light crop, the estimated yield per acre of slightly under 18 tons being 1⅓ tons below average and nearly 3¼ tons less than the high yield of last year. Most counties return under average crops. The estimated total production is 5,457,000 tons, or 1,663,000 tons less than in 1926, and is the lowest recorded since 1896.

Estimates which have been obtained of the yield of SUGAR BEET suggest that the yield per acre of washed and topped roots will be below that of last year, and will probably average nearly 8 tons per acre. The acreage under the crop this year was 222,500 acres, as compared with 125,800 acres in 1926, and

the total production is likely to be about 1,700,000 tons, or about 610,000 tons greater than last year. About three-fourths of the total crop is grown in the eastern and north-eastern counties.

* * * * * *

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

TRIALS OF SPRING BARLEY AND SPRING OATS, 1925-1927

The National Institute of Agricultural Botany, with the co-operation of the Ministry of Agriculture, the Norfolk Agricultural Station, the Lord Wandsworth Agricultural College, Harper-Adams Agricultural College, Seale-Hayne Agricultural College, and the East Anglian Institute of Agriculture, issues the following results of trials of spring barleys and spring oats carried out in the past three seasons. Consideration of the following figures should assist farmers to choose the most remunerative variety; they naturally apply more particularly to the districts in which the trials were made, and it should be noted that the results do not necessarily apply to northern England.

Brief particulars of the trial centres are :—

	Soil	*Sub-soil*	*Altitude*
Cambridge ..	Heavy clay ..	Gault	80 ft.
Sprowston, nr. Norwich	Gravelly loam ..	Gravelly boulder clay	100 ,,
Long Sutton, Hants	Medium to heavy loam	Clay over chalk ..	450 ,,
Leegomery, Salop .	Sandy loam ..	Sand and gravel .	300 ,,
Good Easter, nr. Chelmsford	Heavy boulder clay	London clay ..	200 ,,
NewtonAbbot,Devon	Loam of medium depth	Shale	320 ,,

Spring Barleys.—The comparative grain yields of the barleys in 1927 and the averages for the three seasons 1925-27 are given in Tables I and II, with the averages for the same three seasons of the comparative values per acre in Table III. The yield (or value) of the control variety, Plumage Archer 1924, is taken as 100, and the yields (or values) of the remainder are stated as percentages of it. In the case of certain varieties, as indicated by the notes, figures are not available for all three seasons. The references to quality in the comments which follow the tables are based on valuations and analyses made by the Institute of Brewing's Barley Valuation Committee,

and the figures for value per acre on the combination of these valuations with the yield figures.

TABLE I.—RESULT OF YIELD TRIALS, 1927.

	Cambridge	*Norwich*	*Long Sutton*	*Leegomery*	*Good Easter*	*General Average*
Spratt Archer..	104·4	99·6	109·0	106·8	112·8	106·5
No. 824 ..	104·9	102·7	100·0	105·0	104·7	103·5
No. 825 ..	98·5	101·3	101·0	103·2	111·5	103·1
Plumage Archer 1924 ..	100·0	100·0	100·0	100·0	100·0	100·0
Archer	93·7	86·1	98·3	97·7	98·4	94·8
Sunrise ..	99·4	81·3	91·8	101·8	107·7	96·4
No. 25	91·8	105·0	88·1	103·2	100·9	97·8
Archer Goldthorpe ..	86·6	94·5	88·5	88·4	99·6	91·5

TABLE II.—AVERAGE OF RESULTS OF YIELD TRIALS, 1925-27.

	Cambridge	*Norwich*	*Long Sutton*	*Leegomery*	*Good Easter*	*General Average*
Spratt Archer..	103·1	106·0	102·4	101·8	104·6 (*a*)	103·6
No. 824 ..	101·1 (*a*)	108·9 (*a*)	98·2 (*a*)	105·0 (*b*)	104·7 (*b*)	103·6
No. 825 ..	101·9 (*a*)	101·5 (*a*)	99·6 (*a*)	103·2 (*b*)	111·5 (*b*)	103·5
Plumage Archer 1924 ..	100·0	100·0	100·0	100·0	100·0	100·0
Archer	102·7	96·2	101·5	99·6	99·7 (*a*)	99·9
Sunrise ..	103·3	90·5	95·9	97·0	101·3 (*a*)	97·6
No. 25	96·9	103·7	91·3	98·5	92·8 (*a*)	96·6
Archer Goldthorpe ..	94·2	91·0	85·2	88·7	100·1 (*a*)	91·8

(*a*) = Average of two years, 1926 and 1927 only.
(*b*) = 1927 result only.

TABLE III.—AVERAGE OF VALUES PER ACRES, 1925-27.

	Cambridge	*Norwich*	*Long Sutton*	*Leegomery*	*Good Easter*	*General Average*
Plumage Archer 1924 ..	100·0	100·0	100·0	100·0	100·0	100·0
Spratt Archer..	93·9	107·9	91·5	94·9	103·6 (*a*)	98·4
No. 825 ..	90·0 (*a*)	97·6 (*a*)	87·3 (*a*)	108·2 (*b*)	99·7 (*b*)	96·6
No. 824 ..	88·4 (*a*)	106·3 (*a*)	78·4 (*a*)	111·4 (*b*)	96·2 (*b*)	96·1
No. 25	95·8	102·8	90·7	94·0	91·5 (*a*)	95·0
Archer	93·5	91·4	87·8	95·0	98·0 (*a*)	93·1
Archer Goldthorpe ..	87·9	86·4	86·0	90·5	100·0 (*c*)	90·2
Sunrise ..	89·9	91·5	83·8	91·0	95·0 (*a*)	89·4

(*a*) = Average of two years, 1926 and 1927 only.
(*b*) = 1927 result only.
(*c*) = 1926 result only.

These are all two-row barleys with rather short straws that stand well. The straws of Archer and Sunrise are rather weaker than the others. Archer Goldthorpe, No. 25, and Plumage Archer 1924, are the earliest varieties; Sunrise and Spratt Archer ripen generally last. There is little difference between the others; but the order varies slightly from district to

district. No one variety is more susceptible than the others to disease. Such differences as there are in yield show general consistency from district to district; but, where the differences are small, the relative yields in any particular year are likely to depend on soil and weather conditions. All the varieties are capable of producing excellent malting samples, and, in general, varietal differences are small compared with those due to soil and season; for this reason, the figures in Table III are less authoritative than those in Table II. The chief varietal feature is the regularity with which Plumage Archer 1924 has proved itself the leading barley for quality on all these soils. The quality of this variety, No. 25, and Archer Goldthorpe, is particularly good on the more retentive soils; there is rather less difference between them and Spratt Archer, Archer and Sunrise on the lighter soils. The finer points of difference are dealt with in the individual descriptions that follow.

Plumage Archer 1924 (ears erect, of medium length and width), although in no instance the heaviest yielder, can be relied upon for an excellent crop in any of these districts on soils in good condition. If anything, it has done best in these trials in Hampshire and Shropshire, but, owing to its fine quality, it is probably on the average the most remunerative barley within the farmer's reach. On light Norfolk soils, however, these trials indicate that

Spratt Archer (ears drooping, long, narrow and rather lax) should be given the preference. This variety probably yields more heavily on a wide range of the lighter soils than any other barley at present on the market, and, as its quality is often not much below that of Plumage Archer 1924, it is well worth growing in any of these districts.

Archer (ears drooping, narrow and of medium length) has a reputation for being a hardy variety very resistant to adverse climatic and other conditions. It is generally of sound quality, but not equal to either Plumage Archer 1924 or Spratt Archer.

Sunrise is a recently introduced barley of the Archer type.

Archer Goldthorpe (ears rather short and wide and slightly bowed when ripe) often makes a pretty sample, but this does not compensate for its low yield.

No. 824 and *No.* 825 (ears swan-necked, narrow, of medium size and density) are products of an Archer × Plumage cross from the Cambridge Plant Breeding Institute. They

are not yet on the market and have to undergo a further year's test before their future is decided. Their grain, of a bold Chevallier shape, appeals as strongly to the maltster as their yield, in most of these districts, should do to the farmer. Their necks, though fine, are tough, and do not fall even when dead ripe.

No. 25, a selection from Plumage Archer, is similar to that variety botanically and in the field, but in these tests has been slightly inferior in both yield and quality. It is not at present on the market.

Spring Oats.—The results for 1927 are given in Table IV, and the averages 1925-27 in Table V. The figures are less complete than in the case of the barleys. The yield of Abundance, the control, is expressed as 100.

TABLE IV.—1927 RESULTS.

	Cambridge	*Norwich*	*Leegomery*	*Good Easter*	*Newton Abbot*	*General Average*
Golden Rain ..	103·0	110·2	110·6	117·5	134·8	115·2
Victory ..	97·9	127·2	113·2	130·2	131·3	120·0
Thousand Dollar	107·5	111·6	106·7	110·5	103·1	107·9
A 88	88·0	95·8	109·2	101·9	100·0	99·0
Abundance ..	100·0	100·0	100·0	100·0	100·0	100·0

TABLE V.—AVERAGE OF 1925-27 RESULTS.

	Cambridge	*Norwich*	*Long Sutton*	*Leegomery*	*Good Easter*	*Newton Abbot*	*General Average*
Golden Rain	110·6 (*a*)	125·3	110·0 (*b*)	111·0	105·1 (*a*)	134·8 (*c*)	116·1
Victory ..	110·3 (*a*)	118·6	106·4 (*b*)	107·4	119·1 (*a*)	131·3 (*c*)	115·5
Thousand Dollar ..	107·5 (*c*)	111·6 (*c*)	—	105·9	110·5 (*c*)	103·1 (*c*)	107·7
A 88 ..	100·0 (*a*)	112·9 (*a*)	94·6 (*b*)	101·8 (*a*)	106·3 (*a*)	100·0 (*c*)	102·6
Abundance..	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Black Tartarian ..	97·2 (*b*)	100·8 (*d*)	95·7 (*b*)	90·8 (*d*)	104·3 (*b*)	—	97·8

(*a*) = Average of 2 years, 1926 and 1927 only.
(*b*) = 1926 result only.
(*c*) = 1927 result only.
(*d*) = Average of two years, 1925 and 1926 only.

All these oats have straws of medium length and good strength and quality, with the exceptions that A 88 is shorter than the average, but unusually stout; and Black Tartarian is rather weaker in the straw than the others. Golden Rain is the first to ripen; Victory, Thousand Dollar, and Abundance are three or four days later; Black Tartarian and A 88 take a few days more. There is little to choose between the varieties as regards resistance to disease.

Golden Rain, which has an open head and rather small grain of pale yellow colour and good quality, heads the list for yield everywhere but on the Essex clay. In yield, however, there is little to choose between it and Victory.

Victory has an open head and white grain of medium size and good quality. At the present stage of the investigations Victory appears to be the most remunerative variety to grow on any of these soils.

Thousand Dollar has an open head and white grain of good quality rather on the large size. This is a pure stock from the Plant Breeding Institute and is not at present purchasable. Its yield is equally reliable on light or heavy soil.

A 88 has a close Tartarian type of head, and large white grain with a thick husk. It is a new variety from the Plant Breeding Institute, and its testing is not yet complete. Its yield is not without promise, and might repay a heavier seed-rate, for it does not tiller well. The stoutness of its straw is an important feature.

Abundance has an open head and white grain of good quality rather on the large size. It is a reliable oat for spring sowing, but has failed to yield as well as any of those already mentioned, and there are some grounds for believing it to be more susceptible to *Helminthosporium* disease.

Black Tartarian has a closed head and black grain of medium size and fair quality. Its failure to yield and its tendency to weakness of straw leaves it with little claim on the farmer's attention in these districts.

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JANUARY ON THE FARM

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Review of 1927.—At this time last year, winter operations were fairly well forward, as a result of an exceptionally dry December which had permitted of field work. January was also a dry month, and conditions favourable to ploughing and early sowing extended until the last week of February, when heavy rains caused floods in the lower districts. The wet period with which February ended continued during the first week of March, but a fortnight of excellent weather followed, during which drilling of spring corn and preparations for roots could be pushed forward. At Lady Day, therefore, land work was up to time and autumn corn looked well.

Wet and stormy conditions marked the passing of March. April likewise opened with wet weather; but after the first week or so its main character was its chilly winds and frosts, which checked the growth of corn and grass and damaged

early potatoes. The drying winds also caused heavy lands to bake and become difficult to work down to a good seed bed, although the dry conditions were not unfavourable to cleaning operations.

Very dry and cold weather with frequent night frosts continued through the month of May; consequently cereals made poor growth, pastures soon lost their spring luxuriance, hay crops failed to fill up, and roots germinated badly. Similar conditions continued until the middle of June, by which date pastures were beginning to fail and the prospects of hay, corn and roots to look poor. Mangolds and sugar beet were backward and patchy, the effects of the pygmy beetle and soil-sourness being aggravated by the unfavourable growing conditions, while turnips and swedes had in many cases been taken by fly, which had necessitated re-sowing.

The change came about the middle of June, when there set in a wet period that continued with only short intervals of fine weather until the end of September. The protracted nature of the hay harvest and the high proportion—about 50 per cent. —of seriously weathered fodder will cause the year 1927 to be coupled with 1879 and long remembered as a troublesome season. Not only the hay, but also the corn-harvest was carried out under difficulties, although in many districts very rapid progress with the corn was made during a period of about fourteen days at the end of August and the beginning of September. By means of very long working days and strenuous efforts, some farmers found it possible to secure the whole of their corn in good condition. In the north and west, however, laid crops entailed delay and involved excess of labour in cutting, while in the earliest districts some of the grain had begun to sprout in the sheaves before it could be housed.

Potatoes rapidly died down in August owing to the incidence of blight and the omission of spraying. Root crops at first improved as a result of the rains, but later bulbed only slowly, owing to lack of sunshine; and in some cases they became weedy. Pastures and aftermaths grew abundantly during the wet weather; but the excess of moisture and lack of sunshine diminished the feeding properties of the grass, necessitating the use of dry foods, and, in the case of sheep, caused trouble in the shape of foot rot. Whether further trouble in the form of liver-fluke will ensue remains to be seen, but prudent flock masters are keeping alert to this possibility.

A change for the better came with October, in which month there were quite three weeks of good weather. This was

occupied in the completion of the corn harvest and the lifting of potatoes and mangolds. In some districts an attempt was even made to secure a little more hay. Stubble cleaning, however, could not be undertaken early enough for a large acreage to be dealt with effectively, and notwithstanding that there was an unusual quantity of bottom weedy-growth among the corn crops, little could be done to reduce the virulence of this except to plough it under. Ploughing was being pushed forward, and a beginning had been made with autumn sowing when wet weather again brought field work to a standstill at the end of October. November also was a wet month, in which there were few opportunities for sowing, and the lifting of the sugar-beet crops was carried on under difficulties. At the time of writing, mid-December, therefore, farm work, and particularly the sowing of wheat, is considerably in arrears. Many farmers are now drilling whenever soil conditions permit, and others who do not care to sow between the middle of December and the middle of January are hoping for opportunities to complete their wheat acreage with ordinary winter varieties before the middle of February. Shallow drilling, liberal seeding, and the application of a moderate dressing of complete fertilizer, are three important precautions when drilling during the cold season of the year.

According to the official estimates, the crop-yields of the past season have proved to be not very different from the 10-year averages. This is better than was at one time expected. The yields of corn are actually higher than average, but potatoes, sugar beet, roots and hay are slightly down. The quality of the produce, however, leaves much to be desired; and not only have costs of production been inflated by the additional labour necessarily employed in their harvesting, but the land has deteriorated both in cleanliness and in physical condition as a result of its continual state of wetness. Grassland as well as arable has, where the drainage is at all defective, visibly deteriorated, which accounts for the many inquiries now being made concerning the practicability of mole draining.

The prices of farm products fell from an index level of 149 in January to 143 in March, 141 in June, and 137 in November. The chief factors in the fall in general price level were the decreasing values of fat cattle, sheep and pigs. Prices of stores followed those of the fat animals, making 1927 a poor year for the breeder as well as for the feeder of live stock. Wool, eggs, milk and dairy produce have either improved or maintained their values as compared with the previous year, but

the improvement in barley and oats prices are the only material increases which interest the arable farmer. Wheat, which has maintained its values in recent years as well as or better than most farm products, declined in price during the autumn mainly as a result of the greater supply available in the exporting countries, but, doubtless, also partly on account of the heavy deliveries of rather soft home-grown corn. The chief complaint during the past year as regards prices, however, has been with respect to those realized for meat; and the farmer's dissatisfaction has been aggravated by the fact that retail prices have not fallen in proportion to the drop in farm values of home-produced fat animals. Thus, while fat cattle in October sold for prices representing only 23 per cent. above the 1911-13 figures, the retail prices of ribs and thin flanks of British beef were officially recorded at 68 per cent. and 37 per cent. respectively above the pre-war level.

Farm Profits and Losses.—A perusal of the reports recently issued by the Advisory Economists attached to our agricultural colleges shows that certain branches of agriculture are still profitable. Perhaps the most consistently remunerative department of the farm is the poultry. Dr. Ruston's figures for Yorkshire farms have often been mentioned in farm publications. Mr. Wyllie in the Wye Economics Report No. 4 shows a total profit of £699 under this heading on 11 typical farms during the three years 1923–26. In the Cambridge Economics Report No. 8, dealing with seven East Anglian farms in 1926–27, Messrs. Carslaw and Gianetti record a net return of £310 on a capital outlay of £400 on poultry, a return of over 80 per cent. In Report No. 6, concerning 13 other East Anglian farms in 1925–26, the return on £429 invested in poultry amounted to £483, or 113 per cent. There is no doubt that, with modern knowledge of poultry feeding and the aid of the improved laying strains now available, profitable results can be obtained from poultry keeping on a larger scale than is represented by the capital invested in poultry on the above-mentioned farms. Many farmers are to the writer's knowledge finding that poultry keeping, carried on under proper management, is a valuable aid to profitable husbandry.

So much has been heard of the losses connected with arable cultivation that many people have come to the conclusion that corn production under present conditions is unprofitable. Now it is very difficult to single out one crop or group of crops

in a system of husbandry and say that the profits or losses are attributable to this or that crop or group; but that task has been performed by our Advisory Economists, and their figures show that it is not the corn crops that are the source of the arable farmers' losses: it is the crops grown for feeding to meat-producing animals. In the Wye Report above mentioned, the corn crops show a profit of £2,310, and a profit of £2,879 was made on milk production in the three years; but the losses on stock other than dairy cows were heavy. The various reports from the Cambridge Farm Economics Branch also support the view that corn-production can still be carried on profitably if it can be relieved of the unprofitable crops and stock with which it is, in typical arable farming, so closely associated.

Mechanical Power.—After the fall in prices during 1921, and the resumption of the grassing-down policy, interest in tractors and other forms of mechanical power for farm purposes rapidly declined. The purchase of new tractors almost ceased and the propaganda work for the extension of tractor cultivation came to an end. The general impression spread about that tractors were not of material aid in agriculture, and many farmers allowed theirs to fall into disrepair. Recently, however, there has been a recognizable revival of interest in this source of power. Farmers, who have continued to use tractors for ploughing, hauling the self-binder, and other heavy work, and have taken good care of their engines, have found that mechanical power in this form is a valuable supplement to the power available in the form of horses; the rate of depreciation and the cost of repairs have not added so greatly to the cost of tractor operations as was formerly expected; and the possession of handy mechanical power, when well understood and properly handled, has enabled them to reduce their staff of horses without causing inconvenience in the execution of the regular operations of the farm.

In a recent visit to certain arable districts of Germany, I observed that tractors have gained full recognition as necessary and valuable aids to land management. At the 1925 census of farm machinery in Germany, about 7,000 farm tractors were recorded, in addition to 1,600 sets of steam tackle. The numbers of the latter have diminished by several hundreds since the introduction of the lighter form of mechanical power. In recent years, a preference for the caterpillar-track type of tractor seems to have developed, and the great difficulty

formerly encountered with this type—the cost of repairing or renewing the track—has been overcome. An English arable farmer who accompanied me, however, while recognizing the value of tractors and the need for mechanical power in arable farming, pointed out that the possibilities of improving the steam-tackle engine have not been seriously considered for many years. In his opinion, the requisite power could be concentrated in an engine of less than half the weight of the ordinary ploughing unit; and that, by the adoption of the most up-to-date principles of boiler construction and engine design, it would be possible to offer the farmer an economical engine that would be suitable both for cable ploughing and for such direct-haulage operations as corn cutting.

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NOTES ON MANURES FOR JANUARY

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Artificials Only.—The accepted view, with regard to the use of artificial fertilizers for arable purposes, is that they should be employed as a supplement but not as a substitute for farmyard manure. This arrangement has been found to work well in practice and fits in with the fact that, on the vast majority of holdings, a certain amount of farmyard manure is available for use on the land without any alternative means of profitable disposal. It is also admitted that, on most soils, dressings of dung promote a condition of liveliness and workability quite apart from the manurial action, and that these physical effects are of the greatest value.

It is often assumed, however, that artificial manures used alone are unsuitable for maintaining fertility; and, since in practice it is sometimes necessary to crop without dung for a series of years, it is of interest to examine experimental results obtained by the use of artificials, alone, for long periods. There is no doubt that the successful use of fertilizers without dung requires a knowledge of their properties and their relations to soils and crops; but that they can maintain fertility for a considerable time, and compare not unfavourably with repeated doses of dung, has been shown in a number of trials, the main findings of which may be mentioned here. In most of the recorded cases, yearly applications of farmyard manure have been compared with annual doses of a complete mixture of fertilizers, the dung providing more total plant food than the artificials but, probably, rather less

plant nutrients in a readily available form. Experiments of this type have been carried out on light and on heavy soils, with continuous cropping and with rotation farming, in each case over a number of seasons. The crops grown included a series of market garden crops. Some of the results are :—

ROTHAMSTED (HEAVY SOIL), CONTINUOUS CROPPING.
Average Yields per Acre.

Manures to each Crop	*Wheat* 71 seasons	*Barley* 70 seasons	*Mangolds* 45 seasons
No manure	12 bu.	15 bu.	3½ tons
14 tons dung (approx. 186 lb. N.) ..	34 ,,	46 ,,	18 ,,
Complete artificials—			
(43 lb. N.)	22 ,,	41 ,,	—
(86 lb. N.)	31 ,,	—	18 ,,

WOBURN (LIGHT SOIL), CONTINUOUS CROPPING SINCE 1876.
Average Yields per Acre, 1915-24.

Manures to each Crop	*Wheat*	*Barley*
No manure	8·0 bu.	9·6 bu.
7 tons dung (approx. 82 lb. N.)	20·6 ,,	27·7 ,,
Complete artificials (20 lb. N.)	18·4 ,,	18·7 ,,

SAXMUNDHAM (HEAVY SOIL), ROTATION CROPPING.
Average Yields per Acre, 1910-23.

Manures to each Crop	*Wheat* 13 crops	*Mangolds* 13 crops	*Barley* 12 crops	*Peas and beans* 10 crops	*Clover-hay* 3 crops
No manure ..	18 bu.	5 tons	17 bu.	20 bu.	32 cwt.
6 tons dung (72 lb. N.) ..	29 ,,	18 ,,	30 ,,	39 ,,	80 ,,
Complete artificials (30 lb. N.) ..	30 ,,	17 ,,	31 ,,	36 ,,	60 ,,

BRAMFORD (LIGHT SOIL), ROTATION CROPPING.
Average Yields per Acre, 1902-7.

Manures to each Crop	*Wheat* 6 crops	*Mangolds* 6 crops	*Barley* 6 crops	*Peas* 3 crops	*Clover-hay* 2 crops
No manure ..	19 bu.	12 tons	27 bu.	31 bu.	37 cwt.
6 tons dung (72 lb. N.) ..	21½ ,,	16 ,,	38 ,,	29 ,,	33 ,,
Complete artificials (30 lb. N.) ..	25 ,,	18 ,,	39 ,,	24 ,,	29 ,,

KENT (HEAVY SOIL), DYER AND SHRIVELL; MARKET GARDEN CROPS.
Heavy Dressing of Dung=100.

Manures to each Crop	*Cauli-flower* 13 seasons	*Broccoli* 12 seasons	*Savoys* 13 seasons	*Spring Cabbage* 12 seasons	*Brussels Sprouts* 12 seasons
25 tons dung (300 lb. N.) ..	100	100	100	100	100
12½ tons dung (150 lb. N.) ..	82	87	83	92	74
Artificials (135 lb. N.) ..	114	114	112	111	102

The general trend of the above results is in the same direction; and there is no doubt that, under the conditions of the experiments, artificials used alone have maintained the cropping power of the various soils at a level not much inferior to that produced by annual applications of farmyard manure.

Apart from a somewhat more kindly physical condition shown by land receiving farmyard manure, the main difference, between the dunged land and that receiving artificials, lies in the extent of the residual effect which, as we know from certain Rothamsted experiments, is much greater with dung than with artificial fertilizers; and this is particularly so in the case of the nitrogenous constituents.

Cyanamide.—Although by no means a recent addition to the list of artificial manures, calcium cyanamide, which has been extensively used for years on the Continent, has only lately been reintroduced to this country, where it has aroused interest by its relatively low price reckoned on the unit of nitrogen. As first prepared, cyanamide was exceedingly dusty and unpleasant to handle, but improvements in manufacture have done something to combat this. It contains 19 per cent. of nitrogen in the form of calcium cyanamide, with a small proportion of free lime, which, with the other calcium compounds present, is equivalent to about 120 lb. of chalk for every 1 cwt. of cyanamide used. The nitrogen is not immediately available to plants, but has to undergo a series of changes in the soil, partly chemical and partly through the agency of bacteria, the end point being nitrates as in the case of other forms of nitrogen.

The time required for its transformation renders cyanamide somewhat slower-acting than sulphate of ammonia, and for this reason it is best applied well before sowing time. A

further reason for early application is that heavy dressings of cyanamide at sowing may lower the germination of the seed; but this can be obviated if a short time is allowed between applying the manure and drilling the seed. One week's interval for each hundredweight per acre of cyanamide used is said to be sufficient.

Cyanamide, therefore, is a form of nitrogen which should be applied early; its present price—about 9s. 1d. per unit of nitrogen—is attractive; and it might be given a trial as a source of nitrogen for some of the early-sown spring corn, for which purpose the application of 1 to 1½ cwt. per acre might be made after the last ploughing, the manure being worked in during the preparation of the seed bed.

The range of soils on which cyanamide produces its best effect is not, as yet, so fully explored in this country as in the case of nitrate of soda and sulphate of ammonia. Farmers who have not had previous experience with this fertilizer might use cyanamide on part of their area, and apply the same amount of nitrogen to the remainder in the form to which they are accustomed. Such a trial would, of course, only reveal any considerable differences in effectiveness which might exist.

Early Spring Corn.—A manurial programme for the early-sown spring oats and barley may now be considered. In some cases, the land will be sufficiently rich to grow a good crop, as for example after good seeds or sheeped roots. Experience has shown that, at any rate in the wetter part of the country, a light application of phosphate, say 2 cwt. superphosphate per acre, generally helps the crop to stand and fill out under these conditions. On the other hand, if it is known that the land is not in good heart there is reason to provide a more complete dressing containing nitrogen, and, on the lighter soils, potash. This question of potash is important, and many observant farmers are in favour of giving a little potash, especially to spring corn that is to be seeded down, on the ground that, even if the cereal crop does not directly benefit, the clover will do so. Observations of this kind are not confined to light-land farms; they have also been made at Rothamsted on a stiff loam, when the difference, in favour of clover following barley which has received potash, has been very striking. An additional advantage to put to the credit of the potash is the good effect

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending December 14				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 7	11 10	14 10
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 8*	10 8*	10 8*	10 8*	10 1
Calcium cyanamide (N. 19%) ..	8 14‡	8 14‡	8 14‡	8 14‡	9 2
Kainit (Pot. 14%)..	3 7	2 17	2 19	3 0	4 3
Potash salts (Pot. 30%)	5 2	..	..	4 17	3 3
„ (Pot. 20%)	3 17	3 5	3 9	3 9	3 5
Muriate of potash (Pot. 50-53½%)	9 10	8 15	9 1	9 16	3 8
Sulphate „ „ (Pot. 48-51½%)	11 10	10 15	11 7	11 17	4 7
Basic Slag (T.P. 32%)	3 8§	3 3§	3 3§	..	..
„ (T.P. 30%)	3 6§	3 1§	3 1§	2 15c	1 10
„ (T.P. 28%)	..	2 12§	2 13§	..	..
„ (T.P. 26%)	..	2 6§	2 7§	..	..
„ (T.P. 24%)	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P. 58%)					
Very fine grade¶	2 15	..	..	2 10d	0 10
Fine grade‖	2 10	2 10	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 4	3 0	1 9
„ (S.P. 33%) ..	..	..	3 2	..	..
„ (S.P. 30%) ..	2 15	2 12	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 7	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	5 17†	6 2†	6 5	5 17	..
Burnt Lump Lime	1 9	1 12a	1 16b	2 1§	..
Ground Lime	1 18	2 1a	2 6b	1 15§	..
„ Limestone	..	..	1 10b	..	..
„ Chalk	..	1 9	..	1 5§	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station.

§ Price for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull. *b* Delivered to Liverpool area.

c F.O.R. Northern rails 3s. 6d. per ton extra on Southern rails.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R London Stations the cost to purchasers is 2s. 6d. per ton extra.

of a vigorous plant of seeds on subsequent crops in the rotation. Typical dressings under the above conditions would be 2 cwt. superphosphate, 1 cwt. muriate of potash, 1 cwt. sulphate of ammonia, per acre.

As mentioned above, cyanamide might be given a trial for some of these early dressings, when it could replace sulphate of ammonia approximately weight for weight, but would be best applied as a separate dressing a week or so before drilling.

There is a good deal of evidence to show that, provided the barley crop stands up at harvest, and the nitrogen in the mixture does not exceed the equivalent of 1 cwt. sulphate of ammonia per acre, there need be no fear of a lowered valuation for malting purposes.

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NOTES ON FEEDING STUFFS FOR JANUARY

H. E. WOODMAN, D.Sc., PH.D.,
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The Modern Tendency in Animal Husbandry.—No feature of agricultural development is more striking than the marked tendency which has been evinced during recent times in the direction of intensifying the methods whereby meat and milk are produced for human consumption. It has left its mark on every phase of animal husbandry. The pig destined for pork must be fattened during its period of active skeletal and muscular growth, so that it may be enabled to attain the necessary size and condition for slaughter at a comparatively youthful age. The fat lamb is now a common feature, and, in addition, large numbers of cattle are slaughtered at the age of about 18 months to satisfy the demand for "baby beef."

Turning to the dairy cow, few farmers of to-day are satisfied with the modest yields of milk tolerated so complacently by their forerunners in the industry. Rather has this useful animal come to be regarded as a kind of "chemical factory," in which farm foods constitute the raw materials and milk the finished product, the process of conversion being carried out with the utmost intensity and efficiency. Even the humble fowl has not escaped the influence of the prevailing tendency, and is

now being urged to " speed up " its rate of egg production by means of ingenious devices and contrivances.

The reasons for this change of policy (a change which is, by the way, fundamentally sound in the scientific sense) are quite apparent, but do not concern us particularly here. What does concern us, however, is the fact that such a change has not been possible without some drastic revision of the older methods of feeding stock. In the breeding of strains of animals capable of attaining early maturity, the science of nutrition must necessarily keep pace with the art of the breeder. The production of meat and milk is not a process which can escape the implications of the law of the conservation of energy, and intensive production necessarily connotes more intensive methods of feeding. Obviously, in view of this modern tendency, it is imperative that the scientific man should make a closer study than heretofore of the nutritional requirements of young animals. Such studies are, in point of fact, being prosecuted in the case of the pig at the present time in the Department of Animal Calorimetry of the School of Agriculture, Cambridge.

The increased growth rate which must be induced in an animal fed for early maturity must naturally be circumscribed by the limit of the animal's capacity for consuming and digesting food. It may, of course, some day be found possible, by the science or art of breeding, to produce an animal with a capacity for food assimilation much superior to what we are at present accustomed to. This, however, can scarcely be looked forward to with any degree of confidence. The present-day ruminant is already a wonderful digester of food, and is able, by the united digestive activities of bacteria and enzymes, to make very efficient use of many types of constituents which are of little or no use to man. The immediate solution of the problem of enhancing growth rate is clearly to be sought in improved methods of feeding. The digestive powers of the animal must be utilized to the utmost, and, since the capacity for consumption is limited by nature, this end can only be achieved by resorting to feeding stuffs of higher digestibility than those employed in ordinary practice.

In the growing of crops for feeding to highly productive animals, the farmer should be prepared to sacrifice bulk in order to gain feeding value, his object being, " More food value in a smaller bulk." This idea is rapidly gaining ground among the farmers of this country. Pastures are being grazed more

closely than hitherto, so that the herbage may be secured at its phase of minimum fibre content and maximum nutritive value. The growing of other green food for stock should always be so planned that the animals are supplied with a succession of crops in the young and highly digestible condition. In the making of hay for winter keep, the farmer now realizes the advantages of mowing at an early date, before the grass has become coarse and fibrous and of diminished feeding value. The earliest cut of hay should be put aside for inclusion in the rations of rapidly-maturing animals and heavy-milking stock.

The problem of increasing the digestibility of the concentrated foods is not so simple, nor perhaps so urgent, though it will even be worth while to devote some attention to this question. While the cooking of food may increase palatability and ease of mastication, it does not necessarily increase digestibility to any marked extent. In work at Cambridge, for instance, it was found that the cooking of maize for pigs effected only a minor improvement in respect of digestibility. Steaming, followed by rolling into thin flakes. was shown, on the other hand, to bring about a very marked improvement. The writer recalls his first efforts to measure the digestibility of flaked maize. The flaked maize was fed, along with a small allowance of milk, to two Large White pigs, and so digestible was the ration that both animals developed acute constipation, although no such trouble had arisen in an earlier period of the trials, when the animals had been receiving a ration composed of *raw* crushed maize and milk. Accordingly a fresh start had to be made, coarse middlings this time replacing the milk in the ration. There can be no doubt about the extraordinarily good digestibility of flaked maize, and for this reason it is an ideal concentrate for inclusion in rations designed for the purposes of intensive production.

For many years the idea gained from the common interpretation (or misinterpretation) of old scientific work, to the effect that the dairy cow must necessarily be given its maintenance ration in the form of coarse fodder (for example, 20 lb. of hay), has hung like a millstone round our necks. In these days of high production, this idea must be modified. The too liberal use of bulky fibrous food is not consistent with heavy milk production. Much of Mr. Boutflour's success with dairy cows is to be attributed to his timely recognition of this fact, and to his courage in cutting down, very severely

in some cases, the bulky coarse fodder in the maintenance portion of the ration, thus enabling him to increase the concentrated foods, which can best supply the heavy requirements of good milking animals.

It would be interesting to know how far this process of replacement could be pushed without prejudicing the health and well-being of the animal. Trials have been reported from America where dairy cows, while dry in winter, have been fed for limited periods exclusively on corn meal, all coarse fodder being withheld. The animals ceased to ruminate, but did not manifest any signs of suffering or unrest. Bearing in mind the fact that most concentrated foods contain more or less indigestible fibre, he would, nevertheless, be a bold man who would recommend the total elimination of coarse fodder from the rations of even the heaviest milkers. Even in such cases, a small allowance of bulky fibrous food is absolutely necessary, one would imagine, to assist the passage of food residues along the intestinal tract.

Space forbids more than this general reference to the problems involved in feeding for early maturity or intensive production. The writer hopes to deal with certain aspects of the question in greater detail on future occasions. The question of adequate mineral supply, for instance, is one which requires the most careful consideration, since the more rapidly an animal is induced to grow, or the more heavily a dairy cow is made to yield milk, the greater becomes the danger of mineral shortage. The efficient ration for rapid production must supply not only an abundance of easily digested organic matter, but also a generous amount of the requisite mineral substances. Should the feeding stuffs composing the ration be deficient in this latter respect, it is imperative that such deficiency be made good by the addition of a suitable mineral supplement.

In the Notes for next month, it will be shown that an all-round standard of high productivity is unlikely be reached in this country until means have been found for increasing very materially the amount of concentrated food available for farm animals. Professor T. B. Wood's views on this outstandingly important question will be outlined, together with his suggestions as to how the difficulty, arising from the shortage of concentrated foods, may be overcome without any very serious disturbance of the present conditions of farming.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	10 7
Maize	81	6·8	8 12
Decorticated ground nut cake	73	41·0	12 15
„ cotton cake	71	34·0	11 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·45 shillings, and per unit protein equivalent, 2·03 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1927, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	9 16
Oats	60	7·6	8 2
Barley	71	6·2	9 7
Potatoes	18	0·6	2 5
Swedes	7	0·7	0 19
Mangolds	7	0·4	0 18
Beans	66	20·0	10 2
Good meadow hay	31	4·6	4 5
Good oat straw	17	0·9	2 3
Good clover hay	32	7·0	4 13
Vetch and oat silage	13	1·6	1 15
Barley straw	19	0·7	2 8
Wheat straw	11	0·1	1 7
Bean straw	19	1·7	2 10

* * * * * *

DESCRIPTION	Price per qr. s. d.	lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	10 7	0 13	9 14	72	2 9	1·47	9·6
Barley, British feeding	—	—	9 0	0 10	8 10	71	2 5	1·29	6·2
„ Canadian No. 3 Western	38 6	400	10 15	0 10	10 5	71	2 11	1·56	6·2
„ American	36 9*	„	10 5	0 10	9 15	71	2 9	1·47	6·2
„ Danubian	36 9*	„	10 5	0 10	9 15	71	2 9	1·47	6·2
„ Karachi	38 0†	„	10 12	0 10	10 2	71	2 10	1·52	6·2
„ Persian	35 6	„	9 18	0 10	9 8	71	2 8	1·43	6·2
„ Russian	37 3	„	10 8	0 10	9 18	71	2 9	1·47	6·2
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1·70	7·6
„ „ black and grey	—	—	9 15	0 11	9 4	60	3 1	1·65	7·6
„ Irish, black	—	—	9 10	0 11	8 19	60	3 0	1·61	7·6
„ „ white	—	—	10 13	0 11	10 2	60	3 4	1·78	7·6
„ Argentine	29 0	320	10 3	0 11	9 12	60	3 2	1·70	7·6
„ Russian	28 6†	„	10 0	0 11	9 9	60	3 2	1·70	7·6
Maize, Argentine	36 9	480	8 12	0 11	8 1	81	2 0	1·07	6·8
Beans, English, winter	—	—	9 0†	1 6	7 14	66	2 4	1·25	20
Peas, English, blue	—	—	15 5†	1 3	14 2	69	4 1	2·19	18
Dari, Palestine	—	—	11 5	0 13	10 12	74	2 10	1·52	7·2
„ Persian	—	—	10 0	0 13	9 7	74	2 6	1·34	7·2
Millers' offals—									
Bran, British	—	—	8 5	1 3	7 2	42	3 5	1·83	10
„ broad	—	—	9 5	1 3	8 2	42	3 10	2·05	10
Middlings, fine, imported	—	—	10 5	0 18	9 7	69	2 9	1·47	12
„ coarse, British	—	—	8 17	0 18	7 19	58	2 9	1·47	11
Pollards, imported	—	—	8 0	1 3	6 17	60	2 3	1·20	11
Meal, barley	—	—	11 15	0 10	11 5	71	3 2	1·70	6·2
„ maize	—	—	9 5	0 11	8 14	81	2 2	1·16	6·8
„ „ S. African	—	—	8 12	0 11	8 1	81	2 0	1·07	6·8
„ „ germ	—	—	9 2	0 16	8 6	85	1 11	1·03	10
„ „ gluten feed	—	—	9 5	1 1	8 4	76	2 2	1·16	19
„ locust bean	—	—	8 17	0 8	8 9	71	2 5	1·29	3·6
„ bean	—	—	12 0	1 6	10 14	66	3 3	1·74	20
„ fish	—	—	21 0	3 10	17 10	53	6 7	3·52	48
Maize, cooked flaked	—	—	10 17	0 11	10 6	85	2 5	1·29	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 10	1 11	10 19	74	2 11	1·56	25
„ „ „ 10% „	—	—	12 0	1 11	10 9	74	2 10	1·52	25
„ „ „ 9% „	—	—	11 12	1 11	10 1	74	2 9	1·47	25
Soya bean „ „ 6% „	—	—	11 10	2 4	9 6	69	2 8	1·43	36
Cottonseed cake „ 5½% „	—	—	8 0	1 10	6 10	42	3 1	1·65	17
„ „ Egyptian, 5½% „	—	—	7 4	1 10	5 14	42	2 9	1·47	17
Decorticated cottonseed meal, 7% oil	—	—	12 0*	2 5	9 15	74	2 8	1·43	35
Coconut cake, 6% oil	—	—	10 0	1 6	8 14	79	2 2	1·16	16
Ground-nut cake, 7% oil	—	—	10 7*	1 7	9 0	57	3 2	1·70	27
Decorticated ground-nut cake, 7% oil	—	—	12 15*	2 5	10 10	73	2 11	1·56	41
Palm kernel cake, 6% oil	—	—	9 10*	0 19	8 11	75	2 3	1·20	17
„ „ „ meal, 6% oil	—	—	10 0*	0 19	9 1	75	2 5	1·29	17
„ „ meal 2% „	—	—	8 12†	1 0	7 12	71	2 2	1·16	17
Feeding treacle	—	—	6 10	0 9	6 1	51	2 4	1·25	2·7
Brewers' grains, Dried ale	—	—	8 0	1 0	7 0	49	2 10	1·52	13
„ „ „ porter	—	—	7 10	1 0	6 10	49	2 8	1·43	13
Malt culms	—	—	6 10*	1 9	5 1	43	2 4	1·25	16

* At Bristol. † At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P_2O_5, 8s. 10d.; K_2O, 3s. 3d.

MISCELLANEOUS NOTES

The Agricultural Index Number

AGRICULTURAL produce during November was 37 per cent. dearer than pre-war, as compared with 40 per cent. in the previous month and 48 per cent. in November, 1926.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

	Percentage Increase compared with the Average of the corresponding month in 1911–13					
Month	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	42
September	59	52	61	55	55	43
October	61	50	66	53	48	40
November	63	51	66	54	48	37
December	61	55	65	54	46	—

Grain.—Wheat prices declined by 5d. per cwt. on the month to an average of 10s. 1d. per cwt., and at 34 per cent. above the base years the index number was 8 points below the level of October and 32 points below that of November, 1926. A fall of 1s. 5d. per cwt. in the average for barley brought the index figure for this cereal 17 points lower to 45 per cent. above 1911-13, but the November price of 12s. 4d. per cwt. is appreciably above that of a year ago, when the average price was 11s. 6d. per cwt. and the index number 35 per cent. above pre-war. Oats remained at about the same price as in the two preceding months, and at 30 per cent. above 1911-13 were dearer than in November, 1926, but at the same level as in November, 1925.

Live Stock.—A further decline took place in the prices of fat cattle and pigs, and these are now at the lowest levels recorded for the current year. Second quality fat cattle averaged 40s. per live cwt., and at 19 per cent. above the level of the base years the index figure was 4 points lower on the month and 12 points below that of November, 1926. Bacon pigs were 6d. and pork pigs 4d. per 14 lb. stone, estimated dressed carcass weight, cheaper than in October, and the relative index figure declined by 4 and 6 points to 18 and 29 per cent. respectively above pre-war. A year ago bacon pigs were 7l

per cent. and pork pigs 76 per cent. dearer than in 1911-13. Store cattle and pigs also showed a fall in price and index number, the former class of stock being about 10s. per head cheaper than in October and the index number 6 points lower at only 13 per cent. above pre-war, while the latter were about 4s. per head cheaper and 12 points lower at 44 per cent. Dairy cattle, fat and store sheep, however, were dearer than in the preceding month, this being the customary movement of prices at this time of year, but whereas the increase in the price of dairy cattle was proportionately higher than in the corresponding period of the base years, the increases in prices for sheep were proportionately lower, and the index figures for fat and store sheep declined by 1 point and 5 points to 40 and 35 per cent. respectively above pre-war. Dairy cattle were 28 per cent. above pre-war, compared with 27 per cent. in October.

Dairy and Poultry Produce.—Butter was about 1½d. per lb. dearer in November than in the previous month, and the index figure was 6 points higher at 47 per cent. above the level of 1911-13, or the same as in November, 1926. Cheese was very slightly dearer, but as the increase was not proportionately so large as in the corresponding period of the base years the index figure was one point lower at 55 per cent. above 1911-13; a year ago cheese was only 28 per cent. dearer than pre-war. Milk contract prices were on average a little higher during November at 59 per cent. above the pre-war level, as against 57 per cent. in October. There was the usual rise in egg prices during November, but the average price per dozen was about 3d. short of that reached in November last year, and the index number was 13 points lower at 47 per cent. above the base years. Poultry prices were generally maintained throughout the month at the levels ruling in October, but geese were dearer and the index number advanced from 43 to 46 per cent. above pre-war.

Other Commodities.—Potato prices were fairly steady during the month under review and the index rose to 76 per cent. above 1911-13, as compared with 72 per cent. in the previous month and 113 per cent. in November, 1926. Hay also was very slightly dearer at 19 per cent. above pre-war. Apples were dearer at about 40 per cent. above prices in the base years, and vegetables at 47 per cent. above pre-war were 3 points lower on the month, cabbages, cauliflowers and Brussels sprouts being cheaper. Wool prices advanced a little, and at 46 per cent. above the level of the base years the index number for November was 3 points higher than in October.

Index numbers of different commodities during recent months and in November, 1925 and 1926, are shown below : —

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927			
	Nov.	Nov.	Aug.	Sept.	Oct.	Nov.
Wheat	49	66	56	48	42	34
Barley	35	35	64	62	62	45
Oats	30	20	43	35	33	30
Fat cattle	48	31	34	30	23	19
Fat sheep	63	43	45	45	41	40
Bacon pigs	79	71	36	34	22	18
Pork pigs	75	76	43	41	35	29
Dairy cows	42	34	25	28	27	28
Store cattle	32	22	26	24	19	13
Store sheep	68	42	48	49	40	35
Store pigs	97	135	70	64	56	44
Eggs	80	60	44	54	66	47
Poultry	49	49	43	37	43	46
Milk	74	64	55	65	57	59
Butter	71	47	38	41	41	47
Cheese	75	28	57	59	56	55
Potatoes	60	113	30	46	72	76
Hay	3	4	16	18	18	19
Wool	52	31	42	43	43	46

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Displays of Home Produce

Universal Cookery and Food Exhibition.—At this Exhibition, which was held at Holland Park Hall from November 15–24, the Empire Marketing Board arranged an attractive display of Empire produce. The home produce section was, as usual, organized by the Ministry in collaboration with the National Farmers' Union, the Food Manufacturers' Federation, the National Food Canning Council, the National Association of Cider Makers, and the National Milk Publicity Council, and was grouped around a lounge in the centre of the Empire Marketing Board stand.

The display of dairy produce included attractive exhibits of trade-marked Cheshire and Cheddar cheeses, as well as crustless cheeses and several brands of tinned milk. With the object of stimulating the consumption of milk, a number of striking features were presented, notably a graphic illustration of Dr. Corry Mann's experiments on the comparative dietetic values of

different foods, including milk. Two cages of white rats were also shown; the rats in both cages had been fed on the same rations, except that in the one case they had water to drink and in the other milk; the rats were only ten weeks old, but the milk-fed ones were already heavier by one-third than the water-fed lot, and were obviously in better condition.

Other exhibits were devoted to fruit, including dessert apples, English tinned fruits, and all varieties of bottled fruits, jams and cider; and a third group covered a good display of English bacon and hams, eggs, preserved meats, cereal products, tinned vegetables, sauces, pickles, etc.

Home produce was well represented at the cooking demonstrations that were given in one of the Exhibition's kitchens.

Display of Home Produce in Fleet Street.—The Ministry has been glad of the opportunity to co-operate in a scheme organized by the *Farmer and Stock-Breeder*. That journal took a shop in Fleet Street for the month of December, and staged there an impressive display of home-produced food, including trade-marked Cheshire and Cheddar cheeses, crustless cheese, Stiltons, condensed milk, butter, eggs, meat, dessert apples, canned and bottled fruits, jams, fresh and tinned vegetables, bacon and hams, preserved meats, cereal products, etc. An interesting feature of the display was an exhibit of beet sugar, and of jams and bottled fruits preserved with this new British product.

As explained by the organizers, the intention was "to demonstrate the resources of our farmers, not only as regards the variety, but also the quality of the foodstuffs they supply; thus to show to the man in the street that British agriculture is far from being the negligible quantity in the national economy that he is sometimes encouraged to believe it is."

The Exhibition attracted a considerable amount of attention amongst the thousands of people passing the shop every day, and the organizers are to be congratulated on their enterprise in initiating this venture and on the success which attended it.

The Prime Minister visited the shop in company with the Minister of Agriculture, and made a thorough inspection of the exhibits. He was particularly interested in the examples of trade-marked Cheshire and Cheddar cheeses and, before leaving, expressed the hope that the Exhibition would be staged in future years on a much larger scale.

Although directed mainly to the consumer, the Exhibition is not without interest to the producer. To quote again from

Display of Home Produce in Fleet Street, London. Corner of the Fruit Section.

Display of Home Produce in Fleet Street, London. Corner of the Dairy Section, showing trade-marked Cheshire and Cheddar Cheese.

the *Farmer and Stock-Breeder*: "As we see it, the main lesson of the Exhibition to the producer is not new, but an old one emphasized. We must concentrate on a quality in our produce that will maintain it on a plane of its own. But this is not enough. We must put it before the consumer in a condition that will make its merit apparent, its claim insistent; in brief, good articles, well marketed."

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Pig Recording Scheme for Scotland

A SCHEME for Pig Recording, confined, in the meantime, to Scottish breeders, is being put into operation immediately by the Animal Breeding Research Department of the University of Edinburgh, to which communications on the subject should be addressed. The scheme has the active support of the Board of Agriculture for Scotland. The details of the scheme are as follows:—

Scheme for Advanced Registry of Pigs in Scotland.—That one or more central testing stations be established.

Note: The first is now established at Edinburgh, and thereafter others may be set up throughout Scotland, in accordance with the desires of breeders in the various districts, and the experience gained at Edinburgh.

A breeder wishing to have a sow tested should inform the testing station within 14 days after the sow has farrowed.

The sow must be of a pure breed and entered in the herd book. She must be mated to a boar of a pure breed who is also entered in the herd book.

An eligible gilt (12 to 18 months of age, and with not less than 12 teats) must farrow and raise to 60 days of age at least seven pigs. In a gilt's litter, no pig may be counted as one, unless it weighs at least 26 lb. at 60 days of age.

A sow (over 18 months of age, and with not less than 12 teats) in order to be eligible must farrow and raise to 60 days of age at least eight pigs. In a sow's litter no pig may be counted as one unless it weighs at least 26 lb.

Four representative pigs (preferably two of each sex) shall be sent to the testing station 60 days after farrowing, the males to be castrated around five weeks of age.

Pigs should be delivered to the testing station carriage paid. These will be paid for at the top price.

No entry fee is required meantime.

The Test.—FEED : The feed of the pigs under test will be determined by the authorities at the Rowett Research Institute and will be uniform throughout, varying only with age or weight. It will be designed to encourage as near to optimum development as is practically possible.

All litter groups will be carried to around 200 lb. average liveweight each.

Weights of pigs will be taken on arrival and at regular intervals of 14 days throughout the test.

If one pig dies through disease or accident, the test is continued. If two die, the results will not count.

Measurements of growth will be taken.

Slaughter.—A litter group around 200 lb. in weight per pig will be slaughtered at a recognized bacon factory, and the carcasses graded by a competent judge. The following points will be measured :—

(*a*) Percentage loss, live to deadweight.
(*b*) Percentage loss, deadweight to cured rolled bacon produced.
(*c*) The quality of the Scottish rolled bacon produced.

Award of Points.—Points will be awarded according to the following :—

(*a*) Number farrowed (*b*) Number weaned (*c*) Average weight at weaning	33·3 per cent.
(*d*) Amount of food consumed per pound liveweight (*e*) Rate at which the litter group reaches 200 lb. average	33·3 per cent.
(*f*) Percentage deadweight (*g*) Percentage curable meat. (*h*) Quality of bacon	33·3 per cent.

Note : This emphasizes (1) prolificacy ; (2) good milking of the sow and her ability to bring up a litter ; (3) early maturity ; (4) economy, and (5) quality.

Litter groups will be placed into Grades I, II or III, according to the number of points obtained. They will also be graded in each of the three groupings specified in paragraph 15 for which 33·3 per cent of the points are awarded. The reasons will be given as to why any litter group fails to reach Grade I.

By this means it is hoped that it may be possible to establish some system of advanced registry similar to that which is at present in force as regards dairy cattle. It cannot be disputed that milk registry in dairy cattle has provided an extraordinary stimulus towards the production of better milk producers. In view of the present circumstances, it is considered that the time is opportune for the application of a

similar scheme in bacon pigs. It is hoped later to extend this scheme in a modified form to pork pigs also, but, in view of the urgent need for a standardization of bacon type, it has been decided to push on with the above.

Advisory Committee.—The first testing station is already established at the Animal Breeding Research Department, West Mains, Edinburgh. A committee, appointed by the Scottish National Association of Pig Breeders and the Scottish Pig Industry's Committee, to advise and guide the work, has approved the above scheme. The Committee consists of :—

The Rt. Hon. Lord Hamilton, K.T., of Dalzell, Motherwell.
Major W. A. Baird, Lennoxlove, Haddington.
Mr. George Bruce, Inschfield, Insch, Aberdeenshire.
Mr. T. R. Cavaghan, of Cavaghan & Gray, Bacon Curers, Harraby, Carlisle.
Mr. J. E. B. Cowper, Gogar Mains, Corstorphine.
Major Falconar-Stewart, M.C., Feddal, Braco.
Mr. A. N. Haig, Springfield, Kinross.
Mr. R. Miller, Ferrygate, Dirleton.
Mr. R. W. L. M'Caig, Foreside of Cairn, by Kirriemuir, Forfarshire.
Mr. Alex. Main, representing the Board of Agriculture for Scotland.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending November 15, legal proceedings were instituted against four employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Dorset ..	Gillingham	12	0	0	2	2	0	43	15	0	3
Yorks, E.R...	Bridlington	3	0	0	0	10	0	20	0	0	3
Kesteven and Lindsey	Louth ..		—		5	10	6	11	18	0	3
Derby ..	Burton ..	4	0	0	4	16	0	11	15	0	2
		£19	0	0	£12	18	6	£87	8	0	11

The important point in the case heard at Louth was that the workers were engaged on contracts of service which provided that they should be boarded and lodged by the foreman and paid a net weekly cash wage which was 18s. less than the minimum rates due. In effect this arrangement (other instances of which, it is believed, have occurred in the area) was equivalent to a deduction of 18s. per week in respect of the provision of board and lodging, whereas under the Agricultural Wages Committee's Order the maximum deduction allowable in respect of such provision is 15s. per week. It is interesting to note that the defendant's solicitor stated that the opening speech by the Ministry's legal representative had disposed of any defence which he could have raised, and he would, therefore, have to plead "guilty" to the charges.

Destruction of Weeds.—The Ministry recently served notices under the Corn Production Acts (Repeal) Act, 1921, on four occupiers of lands at Barrow-in-Furness, requiring them to destroy the weeds growing on their lands, and, in three cases, the notices were complied with. On account of the lateness of the season, no action will be taken as regards the remaining occupier, but his lands will be kept under close observation next season.

Authority to lay information on the Ministry's behalf was issued during October in seven cases in which there was non-compliance with notices served under the Act by the agricultural committees of Berks, Essex, Lancashire, Norfolk and East Sussex. Convictions were obtained and fines imposed in four instances; one case was dismissed on grounds of insufficient evidence; while another was not proceeded with as most of the weeds had subsequently been cut. In the remaining case, no report of the result of the proceedings has yet been received.

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Foot-and-Mouth Disease.—Since the report in the last month's issue of the JOURNAL, 20 outbreaks of foot-and-mouth disease have been confirmed in Great Britain, seven of which occurred in the Hampshire (New Forest) area already under restrictions.

Disease was discovered at Shrewton, Wiltshire, on November 26, and at Melksham, Wiltshire, on November 29, and four outbreaks have in addition been confirmed in that district.

A new centre of disease was also brought to light at Birmingham on December 10, and four further outbreaks have been confirmed in that neighbourhood.

In addition, disease was confirmed at Lymm, near Warrington, Cheshire, on December 10. A fresh centre was discovered at Werrington, Stoke-on-Trent, Staffs., on December 21.

Eighty-four outbreaks in all have been confirmed since January 1 last, involving 17 counties and the slaughter of 2,507 cattle, 2,227 sheep, 1,542 pigs and 7 goats.

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NOTICES OF BOOKS

The Potato: Its History, Varieties, Culture and Diseases. By Thomas P. McIntosh, B.Sc. (Edinburgh: Oliver & Boyd. 1927. Pp. xvi + 264, 38 illustrations. Price 12s. 6d.)

The potato has been in this country for more than three centuries, and even now we cannot claim either to understand all its varieties or even define, with accuracy, the most dependable methods for invariably securing reliable crops. It is, therefore, not surprising that books continue to be written on this plant, which annually supplies enormous quantities of food for our national larder.

The writer deals quite lightly with the origin of the potato and the method by which it was introduced into this country without clearing up exactly the question as to whom the credit should be given for bringing it here; he then proceeds to deal in a most interesting way with the people in this country who have been responsible for introducing new varieties of great value to the community. The pride of place, rightly, is given to Mr. Archibald Findlay, who did work of great national importance in raising "Up-to-date," which became the variety in most general use throughout the whole of the British Isles, and, incidentally, allowed the Scottish people to build up a seed potato trade of great importance.

A great many pages are devoted to the botanical structure of the potato plant, which should prove interesting to the student, though perhaps a little beyond the ordinary commercial grower. The various methods adopted by the German, American and British authorities in classifying varieties into groups have been set out. Naturally, they differ, for all the schemes have been chosen for convenience and do not follow any real botanical scheme. The writer lays great stress on the quality of the seed produced, which we have now learned is of even greater importance than the source of origin.

The theory that potatoes degenerate from senility, as was held since the time of Parmentier in 1786, as the writer shows, was disproved when biologists in the present century showed that by growing potatoes in faulty environments, diseases set in which caused degeneration. The degeneration diseases and, in fact, all the diseases to which the potato is prone, have been fully set out in Part V, which constitutes one of the best parts of the whole book. The chapters on cultivation and manuring, though interesting and clearly written, are less convincing than the other parts.

The book constitutes a valuable addition to the literature of the potato, and will prove of great interest to all persons who are making potatoes the subject of special study. It is well illustrated, and the type is clear.

Sugar : Cane and Beet. By G. Martineau, C.B. (London : Sir Isaac Pitman & Sons, Ltd, 1927. Pp. xi + 159. Price 3s. net.)

This is the fifth edition, revised by F. C. Eastick. It deals mainly with the manufacturing side of the industry, and the reviser has added new material on the beet industry, which had not been established in this country when the book was originally prepared. For those who require a popular and concise account of Sugar, from the field to the market, this "little book," as the author himself calls it in the preface to the first edition, is well worth reading, and for those who wish to go more deeply into the subject it suggests more comprehensive works which they may consult.

Silage.—*Die zeitgemässe Grünfutterkonservierung.* By Ludwig F. Kuchler. (Munich : Verlag Dr. F. P. Datterer & Cie. Pp. xvi + 525. Price, cloth boards, 16s. net.)

Numerous accounts of investigations into the problems of ensilage have been published in this country during the last decade. For the most part, however, these have appeared in the columns of sundry scientific journals which are not always easily accessible to the general reader. It is, therefore, believed that a useful service was rendered by the Ministry when it decided to include a summary of English work on ensilage in its series of Miscellaneous Publications. The publication in question, which constitutes No. 53 of the series, appeared during 1926. Despite the appearance of this monograph, however, it is manifest that the subject is still suffering from the lack of a good general textbook, dealing with the question of ensilage from a wider and fuller standpoint than was possible within the limited scope of a Miscellaneous Publication. This deficiency is given further prominence by the recent publication in Germany of a comprehensive treatise on the preservation of green crops by Ludwig Kuchler. This publication constitutes a praiseworthy attempt to bring together all the available information relating to the scientific and practical aspects of the silage question, and it is greatly to be regretted that its usefulness

in this country will be limited by the fact that a sound knowledge of German is necessary for its intelligent perusal.

The book is divided into ten sections. In the first section, the author traces the development of the idea of ensilage from early Egyptian and Roman days down to modern times. He then proceeds in the second section to deal with the significance of ensilage in relation to agriculture in general. The numerous advantages which result from the adoption of the practice are explained in detail. The section closes with a review of the present position of ensilage in various countries. A long third section is devoted to a very thorough study of the scientific aspects of the ensiling process—the explanation of the changes which modify the nature and composition of green crops in the silo; the losses of nutrient matter accompanying preservation; the conditions which may lead to spoiling; the factors which determine the production of different types of silage; the composition and feeding value of silage; the vitamin content of green crops and silage. It is scarcely feasible in this short review to give an adequate idea of the immense fund of scientific information embodied in this section. The fourth section is given over to practical questions relating to the construction and filling of silos. This is followed by a section dealing with the ensilage of crops in the pit and in the tower. The sixth and seventh sections deal with methods designed solely for the production of "sweet" silage. These sections cannot fail to interest English readers, dealing as they do with recent advances and improvements in Continental practice. The various compression methods for making "sweet" silage (Süss press-futterverfahren), as well as the electrical and inoculation processes for achieving the same purpose, are described in minute detail. The economic aspects of the silage question are discussed in the eighth section, while the ninth section deals with the different crops which are suitable for the purposes of ensilage. The feeding of silage to different classes of farm stock is also fully gone into in this section. In the final section, the author gives an interesting account of his experiences and impressions during the course of his "Silostudien" travels in various lands, including this country.

Herr Kuchler has certainly made out a very convincing case for the adoption of ensilage as a normal feature of agricultural activity, and has given point to the old assertion: The silo is the necessity of the poor and the luxury of the rich; it secures for both a fuller and a more independent life.

A New Review of Agricultural Literature. *Deutsche Landwirtschaftliche Rundschau.* Vol. I, Part 1, October, 1927. (Published monthly by J. Neumann-Neudamm, Anhaltstrasse, 7, Berlin, S.W. 11. Price, 3 reichmarks per copy.)

This publication is a further addition to the group of periodicals devoted to the provision of abstracts of agricultural literature. In an explanatory note the editors, amongst whom figure several recognized authorities in German agriculture, express the intention of surveying the whole field of original work carried out in Germany or abroad. Worthy as such an intention may be, it appears doubtful from the first issue whether it will be implemented satisfactorily. Allowing for development, however, on traditional German lines, which produce such valuable periodicals as the Centralblatt für Bakteriologie, Jahresbericht für Agrikultur-Chemie, etc., this new periodical may well become a valuable addition to the agricultural technical Press.

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The Work of Seale-Hayne Agricultural College, Newton Abbot, Devon. (63 pp.) Issued by the College. [378.]

Comber, Norman N.—An Introduction to the Scientific Study of the Soil. (192 pp.) London: E. Arnold, 1927, 7s. 6d. [63.11.]

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Tharpen, A. C., and *Bunker, H. J.*—The Microbiology of Cellulose Hemicelluloses Pectin and Gums. (363 pp.+10 pl.) Oxford University Press, London: Humphrey Milford, 1927, 25s. [576.8.]

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Field Crops

Board of Agriculture for Scotland.—Miscellaneous Publications, No. 3: The Maintenance of Pure and Vigorous Stocks of Varieties of the Potato. (106 pp.+6 pl.) Edinburgh, 1927, 1s. post free. [63.512—194.]

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Kenya Colony and Protectorate.—Report on Wheat Products in Kenya. By *Professor Sir R. H. Biffen.* (39 pp.) Nairobi, 1927. [63.311 (6).]

Live Stock and Feeding

Scottish Agricultural Organization Society.—Report of the Scottish Pig Industry Committee. (40 pp.) Edinburgh: Scottish A.O.S. (Ltd.), 5 St. Andrew Square, 1927, 3d. (post free, 4d.). [63.64; 63.64 : 043; 63.6 : 38.]

Wood, T. B.—Animal Nutrition. (2nd Edition.) (226 pp.) London: University Tutorial Press, 1927, 3s. 6d. [63.6043; 612.394.]

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The Distribution of Population Between Urban and Rural Areas. *E. W. Shanahan.* (Econ. Jour., XXXVII, 147 (September, 1927), pp. 395-403.) [312; 325.3.]

Crop Forecasting in England. *J. A. Venn.* (Econ. Jour., XXXVII, 147 (September, 1927), pp. 404-410.) [31 (42) : 311.]

Agricultural Organization in Belgium. *J. P. McCarthy.* (Studies, XVI, 62 (June, 1927), pp. 317-328.) [331.88 ; 334 (493).]

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Cider. *W. H. Bufton.* (Jour. Inst. Brewing, XXXIII, 9 (September, 1927), pp. 450-458.) [663.3.]

The Control of Tick Infestation and a Related Disease of Lambs in North Wales. *C. L. Walton.* (Parasitology, XIX, 3 (September, 1927), pp. 265-273.) [59.169 ; 619.3.]

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Note on the Losses in Mangels During Storage. *G. T. Pyne.* (Jour. Dept. Lands and Agric., XXVII, 1, pp. 33-35.) [63.332.]

A Preliminary Investigation on the Variations in Moisture Content of Crops during Storage. *F. L. C. Scrivener.* (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 166-170.) [63.31-198 ; 63.512-198.]

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Live Stock and Feeding

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The Economic Value of Pigs on the Farm. *A. G. Ruston.* (Pig Breeders' Ann., 1927-28, pp. 88-97.) [63.64.]

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NOTES FOR THE MONTH

Small Holdings Competitions

UNDER the terms of the Small Holdings and Allotments Acts, 1908-26, small holdings varying in area from one to 50 acres have been provided by every County Council in England and Wales, and by a number of County Boroughs, in order to meet the needs of suitable applicants. The total area of land sold or let by Councils in small holdings under the Acts is over 440,000 acres, the holdings numbering more than 29,000.

In order to encourage better cultivation and management by the occupiers, several Councils have organized competitions for the best-managed small holdings in their area. Usually such competitions are arranged in conjunction with established agricultural shows in the county, and they may be either limited to holdings provided by the Council or open to all smallholders in the county whose holdings fall within the prescribed categories.

The reports of the judges on the holdings entered for competitions of this kind frequently yield illuminating comments on the position and prospects of the competitors, and go far to dispel the pessimistic views sometimes expressed as to the prospects of smallholders in present agricultural conditions. It is by no means uncommon to find that the judges' reports comment both on the high level of cultivation of the holdings, and on the success and contentment of the competing smallholders. The fact which many critics of small holdings fail to realize is that, in some directions, notably in their comparative independence of hired labour and in the personal care and attention they are able to give to all details of the work, smallholders, by dint of incessant hard work, are in a stronger position than many larger farmers. In many cases, the advantages are more than sufficient to counterbalance the obvious disadvantages of working on a smaller scale. That

ignorance of the facts is frequently responsible for criticisms, directed against the small holdings movement, is demonstrated by the instances reported in which practical farmers who had no belief in small holdings have been appointed as judges in these competitions, and have subsequently announced that the experience gained in carrying out the necessary inspections of the competing holdings has resulted in their complete conversion.

One of the most recently instituted competitions of this character was held by the Hampshire County Council in 1927. There were 68 entries in all, and the reports of the judges were very favourable. Certain holdings evoked special mention because of the excellence of the crops and cultivation and the neat appearance of the holdings. On the recommendation of the judges the Committee decided to award additional prizes in two of the six classes into which the entries were divided. The judges also called attention to the beneficial effect which the Ministry's Live Stock Scheme is having on the quality of the stock kept on the holdings.

A similar competition held in Norfolk in 1927 produced an interesting report, in which the judges spoke highly of the cultivation, cropping and condition of the arable land, but expressed the view that the pasture land required more attention. They were agreeably surprised at the number of cows kept by the competitors, and drew attention to several instances of pedigree bulls and boars being kept.

The following extracts are taken from reports of competitions held in recent years in Salop and in the Lindsey Division of Lincolnshire respectively :—

Salop.—It has been a great pleasure to find such a high level of management on the respective holdings.

Most of the holdings are heavily stocked, and it has been a pleasurable surprise to us to find the freedom with which purchased concentrated feeding stuffs are being used.

It is also very gratifying to note that, while many ex-service men are making their mark, some of the leading competitors are men who have worked their way up from the position of farm workers and are now obviously ready to take over even larger holdings, thus proving that the small holdings movement is fulfilling a very real function in providing a ladder for the farm worker to better his position in life.

Lindsey.—On visiting the small holdings, nearly 50 in number, it was very pleasing to find that, with the exception of one or two, they are farmed in such a manner that the tenants cannot help but be successful.

Every smallholder seemed contented and happy, and imbued with the desire to improve his position. Given fair seasons and reasonable rents, and a continuance of the good farming which

was so noticeable, we feel sure that the development of small holdings must be an asset to the county.

We also could not help but notice what a great help to these people our County Agricultural Organizer is with his advice and experiments. It was pleasant to see the readiness with which they sought his guidance and advice.

The reports of these competitions also frequently bring to notice striking examples of individual success due to specialization in some particular branch of the farming industry. Thus, mention was made in the report on the Lindsey competition, referred to above, that one of the competitors had won the Breed Championship Prize for curly-coated pigs at Smithfield Show for six years in succession.

Again, in a recent competition in Middlesex, the winner of the first prize in one of the classes was an ex-photographer who now specializes in pigs and poultry, and the judges, in their report on the competition, commented on his original and effective methods of feeding and housing his stock.

Another conspicuous instance of a successful smallholder is reported from Surrey, where the tenant of one of the Council's dairy holdings, though he had had no agricultural experience before the war, has succeeded three times in winning the Clean Milk Competition for his county and has built up a very profitable business.

A final instance may be quoted of the success of a statutory smallholder in open competitions of a less specialized character. An ex-service tenant of the Wiltshire County Council was successful in winning the First Prize and the Ten Guineas Cup presented by the Beaufort Hunt in the open class in a county competition for the best-managed small holdings, and subsequently the same tenant was awarded a First Prize in a class of smallholders and, also, a Twenty-five Guineas Cup presented by the Avon Dale Hunt, open to all farmers, irrespective of area, farming within the limits of the hunt.

The smallholders' wives, by careful attention to the interior of the dwelling house, as well as the garden, play their part in ensuring the success of the prize winners, and numerous pleasing testimonies to the excellence of these domestic items have been noted.

* * * * * *

Cheshire Cheese guaranteed quality

EXCELLENT progress is recorded by the Cheshire Cheese Federation, details of whose scheme were given in this JOURNAL for March and July, 1927. In a report on the first six months' working of their scheme for placing a branded product of guaranteed quality on the market, it is observed that the

Federation is open for membership to any producer of Cheshire cheese in England and Wales who complies with the conditions laid down. The number of applications for membership received up to December 1, 1927, was 284; of these, no fewer than 204 have been registered as accredited makers. The total output of graded cheese during the first six months of the scheme's operation is estimated at 30,000 cwt. Several thousand hundredweights of graded Cheshire cheese have been sold in London and the southern and eastern counties, thus regaining a market which had been lost for many years. Inquiries have also been received from abroad, and sample consignments have been sent for use upon the liners of a steamship company plying between this country and the East.

By a careful study of the state of the world's market, the Federation has been able to notify makers each week of the price which graded cheese should command. In general, the forecasts have proved to be very near the mark. This service is regarded as one of the most helpful consequences of the scheme, and there is said to be an instinctive drawing together of the far-spread and isolated members into closer and more practical co-operation. The fact that graded cheese has realized anything from ½d. to 1d. per lb. more than the best "ungraded" cheese offered at the same fair, is evidence of the business value of the scheme to makers.

Experience during the first month or two led the Federation to adopt a new rule, which provides that cheese should only be branded with the trade-mark of the Federation after inspection and approval by the official grader. The report states that, "It is notable that this condition requiring official grading has done more than anything else to earn the confidence of all interested in the handling of the product."

The educational value of the scheme has been considerable. The grader, being an expert in dairying, has been able to render assistance to makers who have met with any difficulty, and this service has not been confined to makers who have become accredited; no charge has been made for the advice and help given. It is gratifying that, at the annual dairy shows held during the autumn in various towns, dairies which grade their cheese have been the most successful in carrying off the awards and the bulk of the prize money; with one exception, the championships at these shows have been won by registered makers.

The work of the Federation has been hampered, to some extent, by lack of funds available for publicity, but advertise-

ments have been inserted in trade and other papers, prize money has been given for classes for Cheshire cheese at certain agricultural and dairy shows, and a window dressing competition has been promoted. The Federation has taken advantage of the displays of home produce organized by the Ministry, under the ægis of the Empire Marketing Board, and the graded cheese has been a worthy feature of these stands. In addition, at the International Grocers' Exhibition, London, the Federation had a stand of its own, where a considerable quantity of graded cheeses was cut up and offered in small samples. This exhibition work has resulted in many inquiries and much new business. It may be added that the Federation does not wish to interfere with the established channels of the trade, and has handed all inquiries for graded cheese to factors who support the scheme.

In view of the encouraging nature of the above report, the Ministry has paid the second instalment of the grant of £1,000 which it has made to the Federation in aid of the expenses incurred in the first year's working of this very notable experiment in improved marketing technique.

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"Empire Buying Begins at Home": The Producer's Responsibility

THE continued expression of the belief that "Empire buying begins at home" is beginning to make an impression on the buying public. The Empire Marketing Board's advertising campaign and the exhibitions of home produce arranged, under the Board's ægis, by the Ministry, with the assistance of the National Farmers' Union and other bodies, have played a not unsuccessful part in awakening in townspeople a consciousness of the importance of agriculture and the excellence of the best products of our countryside.

A growing demand will, however, prove of little value to the farmer if supplies of produce of guaranteed quality are not forthcoming continuously and in commercial quantities. Those responsible for the displays at Exhibitions are constantly meeting fresh evidence of the difficulty experienced by the ordinary retailer and the ordinary housewife in obtaining regular supplies of standard home products. Manufacturers using agricultural products also make the same complaint. This difficulty can only be removed if producers are ready to venture on new paths and carry into effect a marketing policy for the good of the industry as a whole. The Ministry's views as to the form which such a policy should take have already

been given in this JOURNAL. It is of interest, therefore, to quote an independent opinion. *The Farmer and Stock-Breeder* recently made the following observations based on the experience gained at the exhibition of home produce promoted by that paper in Fleet Street :—

"The difficulty of obtaining regular supplies will remain as long as our present system of marketing continues. It is in this direction that the Marketing Branch of the Ministry can be of real assistance. They have already laid the foundation, and it remains only for loyal support by producers to build up a much sounder system. My experience of the past fortnight has shown clearly that, if we are to regain the confidence of the town buyer, we must not only produce quality but also a more standard article, and continuity of supplies. This cannot be accomplished by individual effort—marketing must be done by co-ordinated enterprise . . ."

"Briefly summarized, the lessons of the exhibition from the producer's point of view appear to us to be as follows :—

"That there is a strong interest in, and a potentially greedy demand, at relatively good prices, for high-class English produce, carefully graded and presented in attractive form.

"That this demand is partially strangled by reason of the difficulty of obtaining supplies that are constant both in quality and quantity.

"That further organization is required for regulating and ensuring this quality and quantity of supply.

"That schemes analogous to those adopted by the Cheshire and Cheddar cheese-makers, and by some poultry organizations, are a necessary foundation for effective organization.

"That, given this organization, the market could be profitably developed by suitable publicity through such exhibitions as *The Farmer and Stock-Breeder* Show and by general advertising.

"That there is scope for more individual enterprise in getting in touch with consumers to provide direct supplies at retail prices.

"That we can develop the market and prices for home-grown produce by studying quality and regularity of supplies.

"That we can combat overseas competition only by attention to quality and service. They can almost always beat us in price ; we can always beat them in quality—if we take the trouble."

* * * * * *

Bounties on Imported Agricultural Produce

IN the House of Commons, on December 22 last, Major McLean, M.P., asked the Minister if he had any information as to whether any bounties or subventions are given by the Dominions, or by foreign countries, in aid of agricultural produce exported to the United Kingdom. In reply, Mr. Guinness said : Inquiries have been made into this matter, and information has been received in respect of some 20 countries. No case has been found where any bounty or subvention is given to agricultural commodities which compete with British produce, although

cleaned rice exported from Spain received a subvention of 25 pesetas per ton. The countries to which the above statement applies are Canada, India, and South Africa, Argentina, Chile, Denmark, Egypt, Esthonia, France, Finland, Holland, Italy, Latvia, Lithuania, Roumania, Spain, Switzerland, Uruguay and the United States. Information in regard to New Zealand and Australia is not yet available.

* * * * * *

Agricultural Produce from Northern Ireland

THE Departmental Committee appointed by the Government of Northern Ireland in April, 1927, to inquire into (*a*) the cost of transit of farm produce; (*b*) the causes of the difference in prices obtained by producers and the prices charged to consumers; and (*c*) the methods of marketing agricultural produce generally, has now issued its report.*

The report states that the cost of transit of farm produce to the British markets is so high that there is a grave danger of a serious diminution in the export of Northern Ireland agricultural produce: examples are given which show that it is cheaper to convey produce to England from the United States and Germany than from Northern Ireland. The Committee, therefore, recommends that commercial carriers should revise existing rates in the most complete and sympathetic manner with a view to aiding the agricultural industry.

Whilst the difference between the prices realized by the producer and those paid by the consumer is dependent on many factors, it is, in the opinion of the Committee, largely determined by marketing methods. The existing system of marketing is condemned; the distributive chain is too long.

In the Committee's view, the discrepancy in price is caused, not by the immoderate profits of the individual, but by the small profits of the many; the present system represents the maximum competition amongst producers coupled with the maximum of alternative markets for buyers, and unnecessarily depresses prices. By way of improvement, the Committee strongly recommends co-operation of producers and the grading and standardization of supplies.

That agricultural co-operation has been a failure in Northern Ireland is recognized, but it is not, on that account, admitted to be impracticable. The Committee considers that much pioneer work will have to be accomplished before co-operation

* Cmd. 65. His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 9d.

can be generally established, and recommends that, as a preliminary, the Government should initiate an educational campaign in order to create in the minds of the agricultural community—notably of the younger generation—due appreciation of the benefits to be derived from co-operative effort.

Buyers everywhere are now demanding graded and guaranteed produce. Serious injury has been caused to the agricultural industry by the negligence and carelessness of producers and exporters in the methods of grading and packing Northern Irish produce for export. The Committee is therefore in favour of compulsory inspection of exports, but recommends that such legislation should be introduced gradually. Northern Ireland is in grave danger of losing its chief outlets for the important potato industry, owing to the many complaints made by importers of the inferior and undesirable methods of grading and packing. The Committee, therefore, recommends that, as an experiment, legislation should be introduced to deal with the grading, packing, and inspection of potatoes for export; such legislation could be extended later to other agricultural produce for export and also to produce placed on the Northern Ireland market.

Other recommendations are that the postal rates for farm produce should be reduced; that the detention period for live stock entering ports in Great Britain from Northern Ireland should be substantially curtailed if not cancelled; that the production of inferior butter on farms should be discouraged; and that consideration should be given to the establishment of agricultural credit banks.

* * * * * *

Production of Home-grown Beet Sugar

ACCORDING to returns rendered to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during December, 1927, together with the quantity produced during the corresponding month in 1926, was :—

	cwt.
1927	1,169,889
1926	900,738

The total quantities of sugar produced during the two manufacturing campaigns to the end of December were :—

	cwt.
1927	3,315,958
1926	2,373,510

BROADCAST TALK ON "BETTER MARKETING"

[The following brief address on "Better Marketing," given by Mr. R. J. Thompson, C.B., of the Ministry of Agriculture and Fisheries, was broadcast from Manchester on December 13 last.]

IN the time at my disposal, I can only glance somewhat hastily at some of the ideas which are being suggested for the better marketing of agricultural produce. I need not argue the desirability of better marketing. Obviously, any method which suggests a way in which the producer can get a greater return for his output is deserving of consideration. It is equally obvious that there is no simple or easy means by which this can be done or it would have been discovered long ago. Fortunately, however, there is an increasing disposition on the part of producers to study the subject. For example, at the recent Imperial Fruit Show, at Manchester, a Growers' Conference was held, and, although the speakers were at liberty to choose their own subjects, they all dealt in one way or another with marketing. This is a good sign, for it is by frank discussion and close investigation of difficulties that progress is made possible.

The producer in this country is exposed to a double competition: (1) he is competing with his neighbours who are selling the same type of produce in the same way, and (2) he is in competition with overseas co-operative societies or companies organized on a business basis, highly capitalized and controlled by men who devote themselves to the task of supplying the demand in the most effective manner.

The result of this organized competition has been to raise the quality of imported produce so that much of it runs a very close second to the best English produce. It is not as good as the best, though it often surpasses it in appearance. It is usually in a superior position on account of regularity of delivery and evenness of quality. In short, for one reason or another English produce is finding it difficult to hold its own on many wholesale markets. The question is, then, whether any change in methods can be adopted which will benefit the producer by giving him better prices or in any case a better demand.

At this point, it is well to realize that the object of marketing is to supply the needs of the buyer and to endeavour to produce the type of article for which he will pay the highest price. It may be said that this is what every producer

endeavours to do, but when one reflects on the multiplicity of sorts and varieties of the same commodities which are offered for sale, it is evident that there is the greatest difference of opinion as to what is required, and that producers in most cases have no very clear idea as to the true needs of the market. They sell the crops they grow or the stock they fatten; but they have not set out deliberately to supply any particular class of article.

The first step, then, is standardization; that is, the selection of the types of produce most suited to the needs of the market, and the definition of these types according to quality, weight, and other characteristics. This is the real secret of the commercial success of imported produce on the home markets. Practically every imported article on the wholesale food market is more or less standardized, and that is the direction in which British produce needs to move. It is a principle which is applicable to all classes of produce. The extent to which eggs are graded by the leading exporting countries is well known and can be seen in almost every grocer's shop; but grading has also been successfully applied to carcasses of beef and mutton, to fruit, poultry, butter, potatoes, wool, cheese, and many other products.

A beginning has been made in this country. Standard grades have been suggested for eggs, poultry, potatoes, and fruit. In the case of fruit, many growers adopt a system of grading, and find it to their advantage. Grading has just been adopted for both Cheshire and Cheddar cheese. The National Federation of Meat Traders have defined the weights and descriptions of pigs which are most suited to the pork and bacon trades. The next step is agreement as to the types and weights of cattle most suited to the meat trade.

It is by classification of produce into grades according to quality that wholesale trading is facilitated, and business, instead of being conducted on retail lines where each consignment differs from the next, is put on a commercial footing. Apart from business advantages, classification of produce in this way results in the producer being paid top prices for top grades, and encourages and stimulates production of first quality stuff. Thus standardization begins on the farm, and one important advantage of marketing on a standard system is to increase the inducement to produce high grade goods.

Think for a moment of the advantage of an increase in the proportion of first quality produce. In most branches of

agriculture, there is no definite standard of what is first quality. It is a matter of opinion which varies from market to market. What is called first quality at one place is frequently only second quality somewhere else. By a grading system, agreed between producers and distributors, qualities are defined, the producer knows what to aim at, the distributor knows what he is buying. There would still be variations in price, but they would depend more on supply and demand, and less on varying ideas of quality. If the producers knew exactly what the buyer wanted, and the grade which would be likely to realize the best price, he would constantly have an inducement to aim at increasing his proportion of best grade produce; and there is always room at the top! The total wholesale value of the English agricultural output has been estimated at £225,000,000. If 10 per cent. of the output could be raised from second quality to first quality, it would make a difference of millions to the advantage of the producer.

Before progress can be made in standardization, agreement must be reached between producers and distributors as to the grades which can advantageously be adopted. Each commodity needs separate treatment, but, in the case of several commodities, the machinery for reaching agreement exists in various advisory committees of the Ministry of Agriculture on which both the producers and the distributive trades are represented. It is not an easy problem, but if it is approached with an open mind, and with a determination to find a solution, the difficulties will, I believe, prove more apparent than real.

The settlement of grades is one aspect of better marketing. For eggs, fruit and poultry, uniform packing and the use of non-returnable packages are equally important, but the crux of the question is how these newer methods are to be put into operation. Producers can do a good deal by aiming at the production of goods of the agreed standards, but to supply the wholesale markets and to develop the demand for British produce, some form of organized marketing is necessary. To take an example from the egg trade, in areas of surplus production, of which there are many in England and Wales, the output of producers within, say, a 10-15 miles radius needs to be collected together at a central egg packing station, where the eggs would be tested, graded, and packed on a uniform system. Poultry and some kinds of fruit are other commodities which lend themselves specially to centralized sale. Whether such depots are managed by

producers, themselves, acting in combination, or by persons working in conjunction with them is not essential; the method is one which, if properly organized, should stimulate production, and by encouraging the best class of produce give results satisfactory to producers.

This is one type of organized marketing. Other commodities would need different treatment, but the essential idea is the collection, grading, and sale for the wholesale market so as to secure uniformity and regularity in supply. If some such system could be adopted, it would have very definite commercial possibilities. It would result in British produce being sold under conditions similar to those which have led to the development of the market for imported produce. It would then be far more easy for the British farmer to secure a larger share in the increasing demand.

There is another point. Advertisement is the life-blood of modern business, but under present conditions it is very difficult to apply advertising methods to British produce. Standardization, combined with organized marketing, makes advertising possible. One means would be the use of a national trade mark, which would not only identify produce as British but would also be a guarantee of quality. The consumer might be induced to look for the national trade mark when making his purchases, and the British farmer might benefit from the patriotic desire to support home industries, which should be such a valuable asset to the home grower.

To sum up, the two ideas which are essential to any scheme of better marketing are the standardization of grades and the organization of distribution. How they can be applied in practice to the agricultural industry is the problem which lies before the farmers of this country, but, in the last year or two, much progress has been made in studying the subject and in providing a basis for discussion. I hope that some of you are familiar with the orange-coloured Reports on Marketing issued by the Ministry of Agriculture. In these reports, standard grades and standard packages for different commodities are set out in detail, and some suggestions are made as to organization. At agricultural shows this year (1927), the Ministry has been illustrating, by practical demonstrations which have been visited by many thousands of people, the proposals contained in these reports.

In addition, small grants are being made to enable promising schemes to be tried, such, for example, as the grading and

branding of Cheshire and Cheddar cheese, and the grading of fruit and vegetables at the Pershore Fruit Market. Thus, a not unimportant beginning has been made. It is not suggested that the Ministry has any complete or cut-and-dried solution of what is an extraordinarily difficult problem, but it has provided something to work on.

In conclusion, I will only say this: the best commercial brains of the Dominions and of foreign countries are at work trying to enlarge their foothold in the British market. The producer in this country cannot afford to ignore changing conditions. He must not be content to sit idly by and say that "what was good enough for my father is good enough for me." In the business world, manufacturers scrap old methods and old machinery when they have out-worn their purpose. In the agricultural world, no less, we need to consider, without prejudice and with an open mind, whether new methods can be devised for selling our farm produce.

* * * * * *

THE ORGANIZATION OF THE POULTRY INDUSTRY IN ENGLAND AND WALES *

PERCY A. FRANCIS, M.B.E.,

Poultry Commissioner, Ministry of Agriculture and Fisheries.

I. INTERNAL ORGANIZATION.—The organization of poultry-keepers is perhaps more difficult to effect than that of some other classes of the community, partly because so many people keep poultry merely as a subsidiary occupation, and partly because, with a few exceptions, poultry societies, as distinct from the co-operative marketing associations, have not, as a rule, undertaken in the past any responsibility in connexion with the disposal of their members' produce. Consequently the powerful impetus given to an organization by such questions as wages, hours of labour and prices for produce, has not assisted to any appreciable degree in establishing combinations of poultry-keepers, and the total number of organized poultry-keepers is low in comparison with the total number of people who keep poultry.

The present organization of the poultry industry in England and Wales may be said to present two aspects; the internal and the external. The internal organization includes the activities of those poultry-keepers and other persons directly

* Paper read at the World's Poultry Congress, Ottawa, July, 1927.

or indirectly connected with the industry who, through the formation of societies of one kind or another, endeavour by combination and mutual help to protect their common interests, and to further the development of those branches of the industry in which they are specially concerned. The external organization includes the activities of State and local authorities, educational and State institutions. Sometimes, as may be expected, the work of these various bodies overlaps, but, for the purpose of this brief survey, the broad distinction indicated above is conveniently and sufficiently defined.

Work of Poultry Societies.—The work of the poultry societies or associations set up by poultry-keepers is varied in character, and may include one or more of the following forms :—

Educational activities, competitive laying tests, registration of breeders, control of exhibitions and judges, the maintenance of breed standards, the marketing of poultry and eggs, the supply of poultry-keepers' requisites such as feeding stuffs, etc., and, generally, the encouragement and development of poultry-keeping. In addition, the societies, through their appointed delegates, take their part in the work of the National Poultry Council.

The Poultry Club.—The growth of poultry societies in Britain has been spasmodic and disconnected. The oldest society is the Poultry Club, which was established in 1877 for the following purposes :—

(a) to promote the breeding and exhibiting of poultry ;
(b) to defend and protect the interests of poultry-breeders and exhibitors ; and
(c) to suppress and prevent fraudulent or dishonest practices in relation to or in connexion with the breeding or exhibiting of poultry.

This club, which to-day possesses 4,000 direct members besides the members of nearly 300 associated bodies, is responsible for establishing and maintaining proper breed standards. The club offers many cups and special prizes for competitions at shows, and is represented on the Utility Poultry Judges' Registration Board, which is a joint body having as its main object the maintenance of a panel of judges, for utility classes at shows, who can be depended upon not to give prizes to birds deficient in breed points. The Poultry Club is also represented on the Standards Inquiry Committee, a joint body at present examining the various standards with the idea of eliminating any points detrimental to maintaining a full measure of beauty

and utility in the same birds. With the possible exception of a few extremists, the members of the Poultry Club have always aimed at this happy combination of qualities. Associated with the club are the chief specialist clubs which have been established to further the interests of particular breeds. These specialist clubs in many cases guarantee classes at exhibitions and provide cups and special prizes for the breeds with which they are individually concerned.

There is also a large number of smaller societies of different kinds, some of which have both exhibition and utility interests.

Utility Poultry Societies.—The formation of societies dealing specially with the economic or utilitarian side of poultry-keeping did not follow until some years after the establishment of the Poultry Club ; in fact, it was not until about 1896 that the first of these societies, the Northern Utility Poultry Society, was organized. Shortly afterwards the Utility Poultry Club was formed, and to these two organizations jointly belongs the credit of having established the first public laying competition, which was held in 1897, in Yorkshire. The inauguration of this competition may be said to mark the commencement of a period when the attention of British poultry-keepers began specially to be directed to the economic qualities of the fowl, particularly as regards egg production, and when the foundation was laid of our present-day pedigree utility stocks.

The National Utility Poultry Society.—The Utility Poultry Club ultimately became the National Utility Poultry Society (N.U.P.S.), which has some 3,000 members and from 50 to 60 branches and affiliated societies. In conjunction with the *Daily Mail* newspaper and the London and North Eastern Railway Company, this Society conducts at Bentley, Suffolk, the largest laying trials in this country, and probably in the world, since in 1926–27 over 3,000 birds were under test. This Society, which is responsible for the initiation of Utility Shows, is represented on the Utility Poultry Judges' Registration Board, and on the Standards Inquiry Committee. It maintains a headquarters office in London, arranges trade discounts for its members, and conducts much advisory and lecture work. It is also represented by a weekly paper, *The National Poultry Journal*.

The Scientific Poultry-Breeders' Association.—The rapid growth of the Scientific Poultry-Breeders Association (S.P.B.A.), another large national society, is outstanding in the history of the British poultry industry. Started in 1915 with 80 members, this society now has 7,500 members, and

publishes a weekly paper, *Eggs*, having a circulation of about 13,000 copies weekly. Experiments in connexion with the scientific feeding and rearing of poultry have been conducted by the Society for some years, and recently it has established an experimental farm of its own at Rudgwick in Sussex.

Perhaps one of the most important parts of this Society's work is its scheme for supplying feeding stuffs to its members. The principles of this scheme are somewhat unique, inasmuch as the Society itself handles none of the feeding stuffs supplied, but simply arranges prices for specified quantities of approved foods, in lots of one hundredweight (112 lb.) and upwards, with selected feeding stuffs merchants in the various districts in the country, for supply to members in those areas respectively. These members send their orders, together with the necessary cash, to the Society's headquarters, which, in turn, passes on the orders to the appropriate merchants who distribute the feeding stuffs direct to the members. The Society undertakes responsibility to these members for the quality of the feeding stuffs, and to the merchants for the payment of accounts, and for this service charges its members a small commission. So successful has this scheme proved that in the eight months (ending April, 1927) feeding stuffs to the value of £45,745 were supplied to members, and even those members who have not participated directly in the scheme state that they have been able to obtain lower quotations from their own merchants as a result of its operations, and fewer small poultry-keepers complain of having to buy their feeding stuffs in the retail market while selling their produce in the wholesale market.

The Society has now under consideration a scheme, framed on somewhat analogous lines to its feeding-stuffs distribution scheme, for the purpose of marketing its members' eggs. Under this scheme, the Society proposes to handle no eggs itself, but to appoint selling agents in various consuming centres to whom members would consign their eggs to the order of the Society, which would collect payment from the agents, and after deducting a small commission to cover headquarters' expenses would remit cash to each supplier. Members would be required to agree to specified regulations as to grading, packages, quality, etc., and the Society would undertake responsibility for these matters to the agents and for due payment to members.

The Society also conducts a register of breeders, and in many other ways, which need not be touched upon here, wields a powerful and beneficient influence on the development of the poultry industry.

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Distinguished Visitors : The World's Third Poultry Congress, Ottawa, Canada, 1927.

From left to right: Mr. Fred Elford (Director-General of the Congress); Col. the Hon. J. L. Ralston (Dominion Minister of National Defence); The Rt. Hon. W. L. Mackenzie King (Dominion Prime Minister); H.R.H. Prince George; H.R.H. The Prince of Wales; The Rt. Hon. Viscount Willingdon (Governor-General); The Rt. Hon. Stanley Baldwin (British Prime Minister); The Hon. W. R. Motherwell (Dominion Minister of Agriculture).

The Exhibit of H.R.H The Prince of Wales

View showing a portion of the general poultry exhibit, at the Third World's Poultry Congress, which comprised over 6,000 birds.

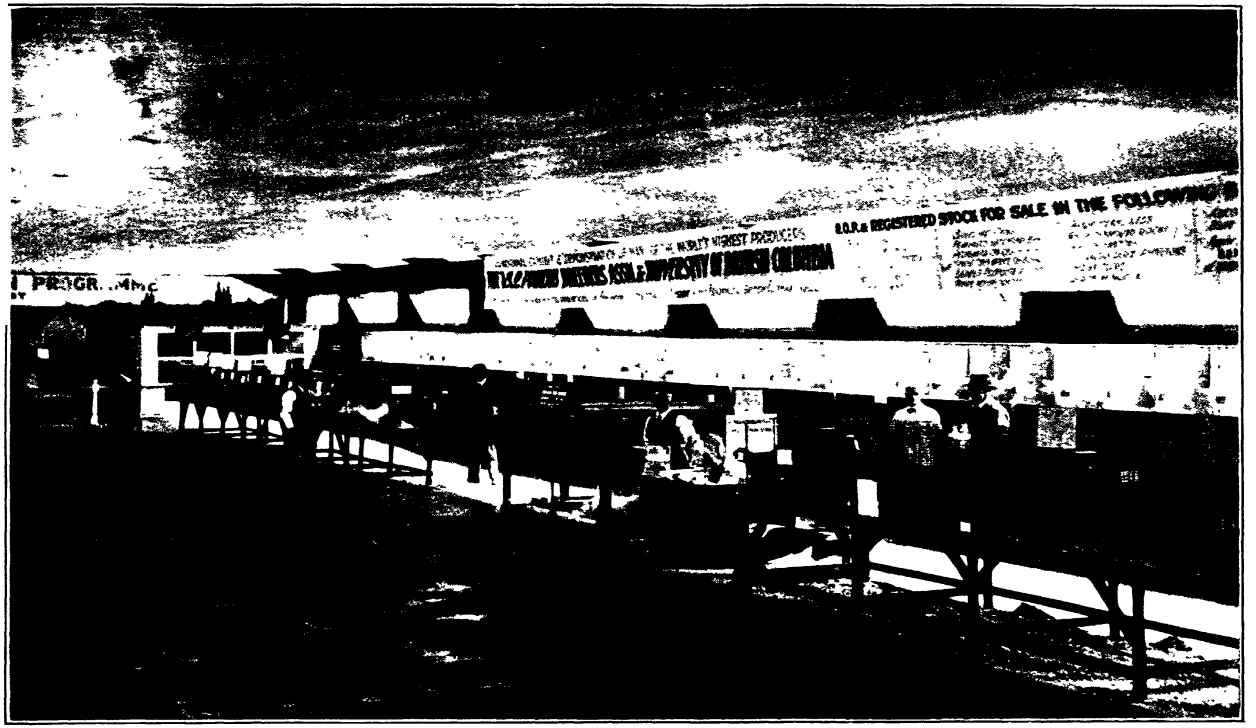

Exhibit of birds by the Record of Performance Association of British Columbia and the University of British Columbia, jointly.

Utility Duck Club.—The Utility Duck Club, which is a comparatively young association, was established to advance and protect all phases of utility duck breeding, including the production of table ducks. It is the only organization in Britain devoted solely to utility duck breeding, and the considerable increase in the popularity of utility ducks and ducks' eggs, which has arisen during the past few years is almost entirely due to the work of this Club. It has a membership of about 500, and is very active in its propaganda and educational work.

Local and Semi-local Societies.—The four societies briefly described above are national in the scope of their operations, since they draw their members from all over the country. There are, however, a number of Federations and Societies which draw their members from local or semi-local areas. Amongst these may be mentioned the Lancashire Federation of Utility Poultry Societies, to which some 39 societies are affiliated, with a membership of about 3,000. This Federation also performs the somewhat unique function of fixing the prices to be paid for eggs each week in Preston and Garstang markets. Rapid developments have taken place in the poultry industry in Lancashire during recent years, nearly 11 per cent. of the total poultry in England and Wales being now found in this county. Further, several laying tests have been organized, including an International Test conducted by the Lancashire Utility Poultry Society in conjunction with the *Sunday Chronicle* newspaper. Over 1,300 birds competed in this test in 1926–27.

Similar federations of poultry-keepers exist in Yorkshire, Worcestershire, and in the Midland area, and there are numerous smaller utility societies in various parts of the country. One or two of these associations operate schemes for supplying feeding stuffs to their members.

Co-operative Marketing Associations.—Though marketing as a special subject does not come within the scope of this paper, it may be stated that there are some 19 co-operative societies in England and Wales which have been established with the main object of marketing eggs and poultry for their members, while some 22 agricultural co-operative societies include this work in their general activities.

The Poulters' Company.—A number of traders' associations exist, but no attempt will be made to deal with them in this

paper. It may, however, be of historical interest briefly to mention the Poulters' Company, which was incorporated by Royal Charter in 1504 during the reign of Henry VII, though as early as 1345 the consumption of poultry in London was sufficient to maintain dealers in such feathered ware. The Charter was renewed by Queen Elizabeth and later confirmed by Charles II and James II. The Charter was subsequently lost during the Revolution, and the present Charter was granted by King William and Queen Mary, in 1692. The original objects of the Company, amongst other things, were to control the marketing of poultry in the City of London, and within a seven-mile compass; to prevent the selling of bad, unwholesome and deceitful poultry ware; and to prevent any person operating in poultry within that area unless such person had first served a seven years' apprenticeship under a freeman of the Poulters' Company. The selling of butter, eggs, coneys and wild fowl was also apparently under the control of the Company. The Company was given power to penalize any person who conspired to raise the price of their goods unduly within the area. This Company recently showed its interest in educational matters by awarding a scholarship to the Harper Adams Agricultural College in connexion with the National Poultry Institute.

Need for Connecting Link: The National Poultry Council.—As can be seen from the foregoing brief details, poultry breeders' organizations are numerous and varied in character, and it is obvious that to enable organized poultry-keepers, as a whole, to bring their combined influence to bear upon any problem of common interest some connecting link is essential. In 1920, therefore, largely owing to the efforts of Mr. Edward Brown, its first President, and now its General Secretary, the National Poultry Council was formed to act as the central representative body of poultry societies, clubs, federations of local societies, societies of co-operators or traders engaged in the distribution of eggs and poultry, and institutions or local authorities engaged in poultry instruction and investigational work. At present the Council actually represents the following bodies:—

8 General Poultry Societies.
6 District Federations.
53 Local Poultry Societies.
10 Specialists' Breed Clubs.
3 Trading Societies.
7 Agricultural Colleges.
13 County Agricultural Education Committees.

The aims of the Council as set forth in its constitution are :—

> "To protect and further the interests of all concerned in the poultry industry, irrespective of whatever branch they may be connected with; to promote the provision of greater facilities for higher training in the subject at public institutions, and the conduct of investigational work of a scientific and practical nature; to influence and co-operate with central and local authorities for the extension of poultry breeding and egg and poultry production; and to undertake such duties as may be assigned to it by the National Poultry Parliament."

The Council has no ordinary members, but patrons are elected on payment of a specified fee. Life members who have rendered important services to the industry may be elected without payment; otherwise the Council is composed of delegates elected by the affiliated societies, etc., mainly on the basis of their membership, except in the case of colleges and institutions. The Council meets at least three times a year, and it delegates to an Executive Committee full powers of administration between those meetings. The Council arranges an annual meeting called the National Poultry Parliament, which is held each year in a different part of the country. Members of the public, in addition to delegates from constituent societies, are allowed to attend these meetings, but such members of the public have no voting power. The Parliament may authorize the Council to take action on any particular question.

Since its inception in 1920, the National Poultry Council has done work of much value to the industry. Perhaps the most outstanding instance is the Council's success in persuading the British Government to allocate a grant of £50,000 towards the establishment and maintenance of a National Poultry Institute, on condition that the Council obtained from the industry one-fourth of the estimated capital expenditure of £26,000. The Council agreed to raise as their quota a sum of £6,500, and have succeeded in collecting nearly the whole of this amount, and the Institute has begun work.

The National Poultry Institute.—The National Poultry Institute, as now established, is not a centralized institution, but is divided into sections which have been allocated to existing teaching or research centres, partly with a view to economy by avoiding unnecessary duplication of staff and buildings, and partly in order that the work of the Institute might be conducted in close association with, and in the atmosphere of, other agricultural education and research work.

Research into nutrition problems has therefore been allocated to the School of Agriculture, Cambridge University, where similar problems in connexion with larger farm live stock have been under investigation for a number of years. Research in connexion with the genetics of poultry breeding is being carried on by Professor R. C. Punnett, who is "Arthur Balfour" Professor of Genetics at Cambridge University; and poultry diseases are being investigated at the Ministry of Agriculture's Veterinary Laboratory at Addlestone, Surrey. The Teaching and Economic Experimental Centre has been established at the Harper Adams Agricultural College, Shropshire, and I should like to take this opportunity of paying a tribute to the excellent work achieved at that Centre by Professor Willard Thompson, who has now returned to New Jersey.

Two practical experimental centres, one to examine problems in connexion with the production and marketing of table poultry, and the other to investigate the effect of various degrees of in-breeding and out-crossing on laying capacity, have been established respectively at Wye Agricultural College, Kent, and at the Cheshire School of Agriculture, Reaseheath.

The National Diploma in Poultry-Keeping.—The Council has instituted a National Diploma in Poultry Husbandry, and has devolved the responsibility for arranging and controlling the necessary examinations for this diploma upon an Examination Board, which includes representatives from the principal Agricultural Education Institutions, from the English Ministry of Agriculture, and from the Board of Agriculture for Scotland. This diploma is intended to indicate a standard of qualification for County and College Poultry Teachers.

Teachers' Certificate in Poultry Husbandry.—Recently, at the request of the Board of Education, the Examination Board has instituted a Certificate Examination for teachers in public elementary and secondary schools who require a knowledge of poultry-keeping for use as a medium in the general education of children in rural areas.

Other Work of the Council.—Considerations of time and space forbid the description here of all the work of the National Poultry Council, but amongst other achievements it might be stated that concessions have been obtained from railway companies and local authorities; an Arbitration Board has been set up to settle disputes between poultry-keepers; a Legal Defence Fund has been established to protect poultry-keepers from unfair assessments for rates and taxes; a register

of Laying Trials has been opened; and the Council now proposes to set up a register for individual birds whose performances in registered laying trials reach a prescribed standard. The Council has also for several years past actively endeavoured to obtain legislation for enforcing the marking of all imported eggs with an indication of their origin. The Merchandise Marks (Imported Goods) Act, which has recently been enacted, gives power, provided certain specified conditions set out in the Act are satisfied, for such marking to be enforced. Finally, the Council has recently turned its attention to marketing problems, and has appointed a special committee for this purpose.

The National Farmers' Union.—Before concluding this Section dealing with internal organizations, reference must be made to two organizations which, whilst not primarily poultry associations, take an active and continually increasing interest in the development of the poultry industry.

The National Farmers' Union, which is the largest association of farmers in Great Britain, has some 110,000 members, 59 county branches, and 1,000 local branches, and exercises a powerful influence in the realm of general agriculture. It may be regarded as of hopeful augury for the future of poultry-keeping on general farms in Britain, and as a sign of the more universal recognition of the growing importance of farm poultry-keeping, that this powerful Union has recently set up an Headquarters Poultry Committee, whilst some 39 of its county branches have established local Poultry Committees, and the number of these is steadily increasing. A few county branches have also inaugurated schemes for marketing their members eggs.

It is probable that at least 60 per cent. of all the eggs and poultry produced in Great Britain come from general farms and small holdings where poultry are kept as a branch of farm live stock. The possibilities of expansion in this direction are very great, and Britain's chief hope in the future of supplying a greater part than at present of her requirements in eggs and poultry appears to rest mainly upon the adequate development and improvement of British farm poultry-keeping. The National Farmers' Union works in friendly co-operation with the National Poultry Council, and the two bodies jointly last year organized a public conference to consider ways and means of improving existing methods of marketing British eggs and poultry, many of which pass through wholesale

marketing channels, though producers and consumers are, in comparison with the position in many other countries, relatively short distances apart.

The National Federation of Women's Institutes.—The second body is the National Federation of Women's Institutes, which is affiliated to the National Poultry Council, and has for its main purpose the provision of an organization with the object of enabling women to take an effective part in rural life and development. In order to achieve this aim, the National Federation endeavours amongst other things to make provision for the fuller education of country women, and to give instruction and training in all branches of agriculture, rural handicrafts, domestic science, hygiene and social welfare. The National Federation has established regulations for the formation of County Federations of Women's Institutes, the number of the latter at the end of 1926 being 3,507. The Institutes exercise a considerable and valuable influence on the development of the poultry industry by organizing courses of lectures, exhibitions and demonstrations, and by taking a helpful interest in the work of the County Poultry Instructors and County Poultry Schemes operated by local education authorities. In several instances, organizations have been established for marketing eggs and poultry in rural areas.

II. EXTERNAL ORGANIZATION.—The Ministry of Agriculture and Fisheries is the Government Department responsible to Parliament, amongst other things, for the proper expenditure of grants made by the State for agricultural education and research. Apart from the work conducted at its Veterinary Laboratory, which was established primarily for investigating diseases scheduled under the Diseases of Animals Acts and other diseases of live stock, the Ministry itself does not, as a rule, undertake directly either teaching or research work, but aids, by means of grants under specified conditions, institutions such as agricultural colleges and research institutions, and county education authorities. As far as the poultry industry is concerned, the Ministry maintains direct contact with it through its Poultry Commissioner, whose duty it is to advise the Ministry on all matters relating to the industry; through its staff of inspectors; and through a Poultry Advisory Committee.

Poultry Advisory Committee.—This Committee includes representatives of producers and traders nominated by the National Poultry Council; nominees of the National Farmers'

Union representing farmers; and a few nominees of the Ministry. It was originated during the war to advise the Ministry on any matter relating to the industry which might be referred to it or which any member might bring forward.

National Poultry Institute Advisory Committee.—Since the establishment of the National Poultry Institute, and at the request of the National Poultry Council, a Committee has been set up known as the National Poultry Institute Advisory Committee, which includes, in addition to members of the Poultry Advisory Committee, further members representing institutions responsible for sections of the Institute's work. This committee advises the Ministry only on Institute questions, the Poultry Advisory Committee retaining its former duties.

Northern and Southern Committees.—Two smaller Sub-Committees are respectively responsible for the experimental work of the Institute which is in operation at Wye Agricultural College and at the Cheshire School of Agriculture, Reaseheath.

Local Agricultural Education Authorities.—There are in England and Wales 63 administrative counties, which are the units for most purposes of local government, and the relative County Councils through their agricultural education committees constitute the county authorities for agricultural education. Most of these county authorities employ a staff of experts, responsible to an organizer of agricultural education, for the purpose of providing instruction and advice to farmers, horticulturists, poultry-keepers, etc., in the county. The Ministry of Agriculture contributes about two-thirds of the total approved expenditure of local authorities on this work, the remaining one-third being defrayed from local rates.

County Poultry Instructors.—Fifty-five counties employ County Poultry Instructors, who, in addition to giving itinerant instruction in the form of lectures and personal visits to poultry-keepers, are responsible for the efficient working of County Laying Trials and the Egg and Chick Distribution Scheme in those counties which operate either or both of those schemes.

County Laying Trials and Egg and Chick Distribution Scheme.—Last year, in 39 counties, there were 324 breeding centres in operation under the Egg and Chick Distribution Scheme, and 13 counties conducted County Laying Trials. Briefly, the Egg and Chick Distribution Scheme is designed to afford small poultry-keepers, such as smallholders and cottagers, an opportunity of obtaining, at reasonable prices,

eggs for hatching, and day-old chicks or ducklings, from pure-bred stock birds with laying pedigrees, or special table qualities, and which are the property of breeders at various centres in the County. These centres, together with the stock birds, are carefully selected by the County Poultry Instructor, who also pays surprise visits of inspection from time to time during the season. County Laying Trials are limited to breeders in the County; they are supervised by the County Poultry Instructor, and the results are published under the authority of the County Council concerned.

Farm Institutes.—In addition to this itinerant educational work, several county authorities, with the aid of grants from the Ministry of Agriculture, have established Farm Institutes, which are designed to provide short courses of instruction in agriculture, etc., of a less extended character than that obtainable at Agricultural Colleges. Sixteen Farm Institutes have now been established in England and Wales, and most of these possess poultry departments for the benefit of their students. Sometimes one or more counties within the area of a Farm Institute establish County Laying Trials at the Institute.

Agricultural Colleges.—Excluding Veterinary Colleges, there are 14 University Departments of Agriculture and Agricultural Colleges in England and Wales. These owe their origin and maintenance either to private, local, or State donations, or to a combination of these. The Ministry of Agriculture aids these colleges usually by means of annual grants, the amounts of which are fixed periodically according to circumstances. Most of the colleges maintain Poultry Instructors and well-equipped poultry departments.

Research Institutions.—The research institutions in England and Wales at which work is being carried on in direct connexion with poultry-keeping are few in number. Reference has already been made to the investigation of poultry diseases at the Ministry's Veterinary Laboratory, and of the genetics of poultry breeding and problems of poultry nutritition at Cambridge University. These institutions are all aided in respect of this work by the Ministry of Agriculture under the National Poultry Institute Scheme. Interesting investigations into the problems of cold storage and preservation of eggs are also being carried on at the Low Temperature Research Station at Cambridge under the Department of Scientific and Industrial Research. One or two other Institutions have worked at particular problems.

Inspectorate.—Through its staff of inspectors, the Ministry supervises the whole of the agricultural education work conducted by local authorities, colleges and institutions, and towards the cost of which it contributes. These inspectors, who include specialists in poultry, rabbit and goat-keeping, and are designated Small Live-Stock Inspectors, are located at Divisional Headquarters, of which there are six in England and Wales. The chief duty of these inspectors is to supervise that part of the work of local education authorities with which they are concerned. They from time to time attend the lectures and demonstrations given by County Poultry Instructors, inspect County Laying Trials, Egg and Chick Distribution Stations, and Stud Goat Centres; attend meetings of local authorities and collect information as required by headquarters. In fact, amongst a multiplicity of duties they act as the "guide, philosopher and friend" of County Poultry Instructors, and through their influence with county authorities (who, as a rule, are only too glad to take advantage of an inspector's knowledge and experience) they function not only as overseers of the expenditure of public money, but as active agents in the development of poultry and small animal industries.

New Markets Branch of the Ministry.—Finally, owing to the growing need for the modernization of methods of marketing English agricultural produce, including eggs and poultry, the Ministry has recently established within its organization a Markets Branch, whose special function it is to investigate marketing methods and marketing conditions generally, with the object of effecting improvements where possible. This Branch has issued two reports dealing respectively with the marketing of eggs and of poultry in England and Wales, and with the origin and character of imported supplies. Judging from the excellent reception given to these reports by the public, and the widespread interest which they have aroused, there is good reason to believe that reform in the methods of marketing English eggs and poultry, which is generally admitted to be long overdue, will in the near future become the objective of combined effort on the part of producers and traders.

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The Ministry desires to acknowledge the courtesy of the Department of Trade and Commerce of the Canadian Government in permitting the reproduction of the photographic views accompanying this article.

THE CONTROL OF SWINE FEVER

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SWINE fever is a very serious disease, which usually causes heavy losses when it breaks out in a herd. Some losses are at present unavoidable, but observation indicates that a very considerable proportion of losses might be avoided if proper methods of control were taken by owners of infected herds.

On June 25, 1926, the disease was diagnosed in the college experimental herd by one of the Ministry's Inspectors, and the disease spreadly rapidly. Serum treatment was not recommended in this case. Detailed experimental work on the disease was not carried out, but the following notes, founded upon careful observations made during the outbreak, may be of assistance to others who have to deal with similar cases. Although the pathology of the disease has been carefully studied,* there are numerous points of detail upon which the pig-keeper who has to deal with the disease cannot find information, for literature on the disease gives but little definite information about the treatment of it.

It is very important that every pig-keeper should be constantly on the look-out for the disease, as, if it is identified early and prompt steps are taken, there is always a chance that its spread may be prevented. The destruction of an ailing pig, and a few healthy ones that have been in contact with it, may save the herd. It may be pointed out that there are probably several strains of the organism (virus) which causes the disease, and these probably affect pigs in different ways—some causing a very acute attack of disease and others only a mild form. The latter may exist in the herd for a considerable time, and spread to a disastrous extent, before its presence is recognized. In one way and another the mild form, if it once spreads through the herd, will cause very serious losses, although comparatively few pigs may actually die from it. The notes given in this paper were made from observations upon a "mild attack" of the disease. If the disease is to be dealt with successfully, it is essential that its nature should be understood; therefore, in the next paragraph, the symptoms observed are described and an account given of the way it attacked the pigs.

* The disease is fully described in the Ministry's Leaflet No. 29.

FIG. 1.—Showing dark-coloured scaling.

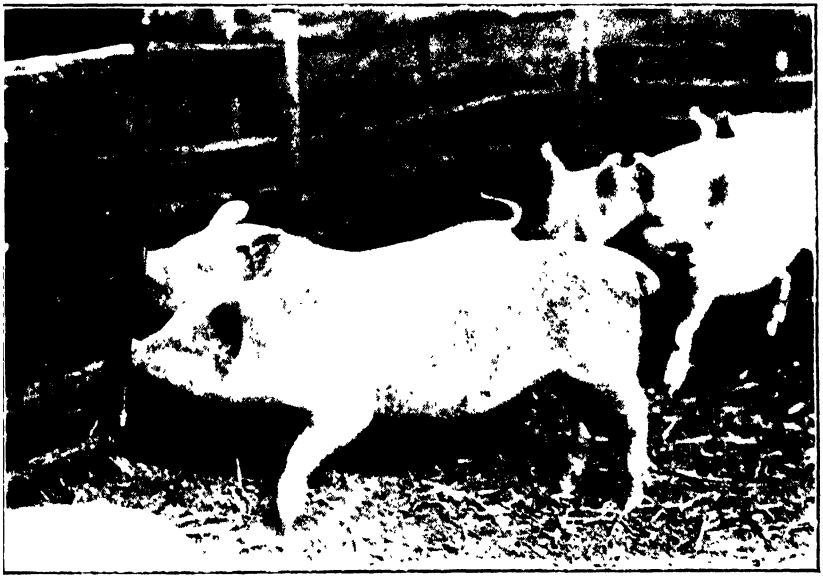

FIG. 2. In the foreground is a typical diseased pig. Many such pigs were successfully fattened. The dirty colour of the hair, referred to in the accompanying article, is to be seen in this pig behind the ear and on the ribs and flanks.

THE CONTROL OF SWINE FEVER.

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FIG. 3.—A diseased pig; this animal proved a "waster."

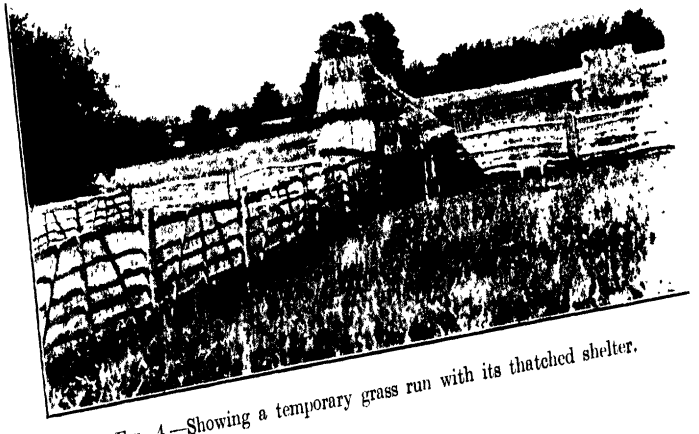

FIG. 4.—Showing a temporary grass run with its thatched shelter.

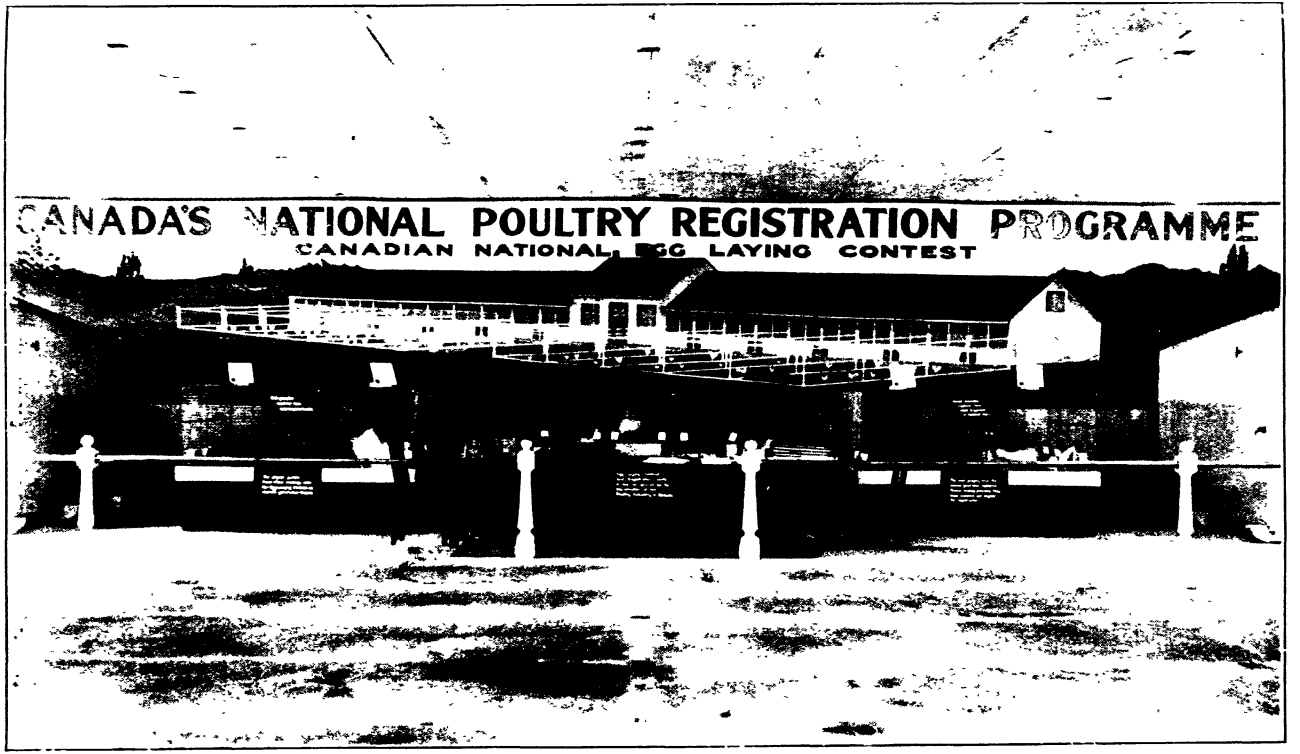

Exhibit illustrating the Canadian Poultry Registration Scheme.

The British Educational Exhibit.

Symptoms of Ill-health.—The following symptoms of ill-health were observed at different times, and, as post-mortem examinations made by the Ministry's Inspectors showed that a number of pigs in the herd were affected by the disease, it seems reasonable to suppose, in view of its highly contagious nature, that many, if not all, of these symptoms were caused directly or indirectly by the disease.

(1) The coat lost its bloom and invariably remained harsh and staring until the pigs began to show signs of recovery. In many cases, the hair and skin of diseased pigs had a dirty colour which could not be removed by oiling. The pigs looked as though they had been smothered by dirty water. A discoloration of this kind was very often noticed down the centre of the back for several weeks after the pigs had apparently recovered. In some cases, the hair became yellow; some pigs were yellow all over, in others the discoloration was in patches. This would, of course, only be observed in a white pig. The skin of many pigs showed a dark-coloured scaling (Fig. 1). This was particularly noticed at the root of the tail. After apparently recovering, the pigs suffered from continual irritation, evidenced by frequent rubbing. Figs. 2 and 3 show typical diseased weaners. The pig shown in Fig. 2 recovered; the one in Fig. 3 died.

(2) All the animals affected suffered with diarrhœa. In some cases, the diarrhœa was thrown off in a few days The others became "wasters."

(3) The ears in practically all cases of young pigs showed a distinct red coloration, but, in a few bad cases, they were blue. Red spots were found upon the belly and legs in a few instances. In bad cases, there was paralysis of the limbs. A considerable number of pigs suffered from lameness, which was usually not persistent but affected different limbs in succession.

(4) Sucking pigs and stores affected by disease lost condition and became very unthrifty. It may be pointed out that before the remedial value of cod liver oil and chalk was discovered, the loss from this source (*e.g.*, loss of condition and unthriftiness) was greater than the loss from death.

(5) A number of pigs were born with scabs upon their faces. These varied in size from that of a threepenny piece to that of half a crown, and were generally situated round the mouth and under the eyes. Large litters were produced by most of the sows which farrowed after the outbreak of the disease, but the mortality amongst pigs at birth was very high, and the litters were very uneven, many containing 60 per cent. of undersized pigs. There were a number of abortions, and the proportion of barren sows was unduly high. In two instances, sows, after farrowing successfully, produced no milk.

(6) Several sows were observed to vomit.

(7) A number of sows were taken suddenly ill; some had a staggering gait; others were dull and listless; foaming at the mouth was a constant symptom with them. Several sows, whilst showing no other external sign of disease, were very restless, exhibiting a strong desire to break out of their pens. Their litters developed disease when between four and six weeks old. Other sows appeared abnormally irritable at the time of farrowing, a few biting wildly at the framework of their pens, or the farrowing rails. In a number of instances, sows could not be made to lie

in the normal position for farrowing, rather lying on their bellies or standing up. Such sows invariably produced particularly weakly litters, from which few, if any, pigs were reared.

Course of the Disease in Growing Pigs.—The disease was usually observed in the pigs when between three and six weeks old, the first indication being loss of bloom; this being followed by a white scour which was very persistent. Some piglings were so badly affected that they were destroyed, but the majority reached an apparent recovery; in nearly every case, however, diarrhœa broke out again between three and seven days after weaning. A few pigs were so badly diseased at this stage that they, also, were killed. The majority again reached an apparent recovery after one to ten days, and a few became "wasters." In the autumn of 1926, examinations were made of the bowels of over 200 pigs of 14 to 18 weeks old which had been attacked as described above, and which had, apparently, recovered. In a large number of these, although no definite evidence of swine fever was found, there was a small amount of enteritis in the cæcum, the inference being that a pig frequently does not completely recover in less than six or eight weeks after the crisis, although, to the eye, it may be perfectly healthy. It is well known that, in some cases, pigs are affected with the disease for as long as 80 days, and it would seem possible that some of these pigs may have been in an infectious condition, and further that such pigs might suffer from a relapse* if exposed to adverse conditions—such as excessive heat or a sudden chill.

Pigs that have been attacked when young and have recovered should therefore be kept carefully isolated, and on no account mixed with healthy swine. It would seem wise to give them good housing accommodation and to fatten them off as quickly as possible.

Methods of Control Tried.—These fall into two categories :—

(*a*) Those designed to prevent the spread of the disease.

(*b*) Those designed to strengthen the pigs' power of resistance.

Measures to Prevent the Spread of Disease.—These are best considered under five headings.

* Several cases were observed in which such a relapse appeared to occur.

Isolation.—In order to enable each lot of pigs to be properly isolated, 24 grass runs were constructed. Each run had an area of one-twentieth of an acre, and was surrounded by a path; the troughs were placed against the fence so that the pigs could be fed without the attendant entering the pen. Fig. 4 shows one of these runs, the hut being made by thatching a hurdle framework. The erection of these additional runs made it possible to empty alternate pens in the permanent buildings.

In spite of the precautions taken from the first, in the early part of September, 1926, the disease broke out simultaneously in nearly all the grass runs. The distribution of the cases in this outbreak seemed to indicate that the disease was being carried in the food, and the possibility of this happening was explored. It was found that, in spite of the precautions taken, infective material was being carried on the shoes of the attendants into the food shed, where it was mixed with the food. The shed was therefore locked up and placed in charge of a man who did not go near any pigs.

Under ordinary farming conditions this may perhaps be a common way of spreading diseases through a herd. The pig-man usually mixes the rations, and very often uses the same shovel and brush in the mixing shed that he uses for cleaning out the sties. There could be no more certain way of spreading a contagious disease like swine fever. The above occurrence and the remedy are therefore specially worthy of notice.

Disinfection.—Tubs of disinfectant were placed at convenient intervals, and the attendants were instructed to dip their feet into the disinfectant before entering and when leaving a sty. It is doubtful if this was completely effective.

Cleansing of Runs.—It is known that the organism which causes swine fever cannot live outside the pig for more than 10 days if exposed to the light. When pigs had been removed from an open-air pen, the latter was therefore kept empty for a period of 14 days. Sties were left empty for 14 days, and subsequently disinfected with Jeyes' fluid.

The Destruction of Ailing Pigs not likely to Recover.—With sucking pigs, it is a comparatively easy matter to see when the animal is so badly attacked that it is not likely to recover; but, when the disease attacks store pigs, it is very difficult, from their appearance, to form an opinion as to the chances of recovery. Many which were apparently badly attacked recovered rapidly, whilst others, which did not appear so ill,

failed to recover and became "wasters." In the early stages of the outbreak in question, several pigs, which ultimately proved to be "wasters," were kept for a considerable period in the hope that they would recover. It was eventually found that store pigs which did not show signs of recovery within 14 days of falling ill, as a rule, failed to recover. This would seem to be a useful test which might obviate unnecessary destruction of many pigs. Thus, each pig which is attacked by the disease should be given a chance for a fortnight; if it is not improving in condition at the end of that time it should be destroyed. Such pigs can rarely be fattened and the food they eat is wasted; in addition, they are a constant source of infection.

When the disease was first diagnosed, an attempt was made to stamp it out by slaughtering every pig showing signs of ill-health. This policy was continued for eight days only, during which time nine pigs were killed; on the ninth day, there were 11 ailing pigs, all in different pens. As it was probable that these pigs had already infected some of those in contact with them, it appeared useless to continue this policy unless contacts as well as diseased pigs were slaughtered. This would have meant the destruction of nearly 100 stores, and even then there would have been no certainty that the disease would be eradicated.

The Destruction of Undersized Sucking Pigs.—It was noted, under "Symptoms of Ill-health" (p. 1003), that many litters contained a number of undersized pigs. Observations made during the early part of the outbreak indicated that a large proportion of these undersized pigs ultimately became "wasters." Consequently, all weakly or undersized pigs were destroyed at or soon after birth. The more rapid growth made by the surviving pigs, owing to the more liberal supply of milk that they obtained, far outweighed the small loss occasioned by the destruction of the small and weakly pigs. Thus, if, in a litter of 12, there are six good strong pigs and six undersized or weakly ones, it pays to destroy the six unsatisfactory pigs at or shortly after birth, if there is disease in the herd.

Measures Designed to Strengthen the Pig's Power of Resistance.—It was found that acid food was injurious to diseased pigs. Before this was observed, it had been customary to soak the rations for 12 hours before feeding; afterwards the meal was mixed with water *immediately before* feeding.

In this connexion, it may be pointed out that many of the most destructive attacks of swine fever have occurred amongst pigs fed upon refuse or whey, both of which are very acid; and, in view of the above observation, it is worth while trying the effect of temporarily discontinuing the use of these and substituting a meal ration, in the event of an outbreak of swine fever. After the contact pigs have been fattened and the pens rested, a return can safely be made to the original method of feeding. It should be noted that all the pigs referred to in this article were fed on a ration containing 10 per cent. of white fish meal.

The diarrhœa from which diseased pigs suffered was checked by feeding chalk (or ground limestone). Two oz. of ground chalk per head per day, fed to sows suckling diseased litters, checked the scour in the litter. The chalk was stirred into the food just before feeding, one oz. being given in the morning, the other in the evening meal. The treatment was continued until the diarrhœa in the young pigs ceased. In some cases, this stopped in 24 hours; in others, it lasted two or three days.

In the case of stores, as previously noted, diarrhœa broke out within a week of weaning. This diarrhœa was checked by feeding one oz. of chalk per pig per day—half an oz. in both the morning and evening meals. This was continued until the diarrhœa stopped. In some cases, the diarrhœa only lasted 24 hours after treatment; in others, it persisted for several days. Feeding chalk on the free choice system was tried and found unsatisfactory, and the addition of steamed bone flour and oxide of iron to the chalk did not give any better result than the chalk alone.

The pigs in grass runs threw off the disease more rapidly than did those in the styes, both before and after weaning. In every instance, there was a noticeable improvement when a group of diseased pigs was transferred from a stye to a grass run.

Cod Liver Oil.—In an outbreak of the "mild form" of swine fever, the number of pigs of over a month old that die from the disease is usually comparatively small. A considerable number, however, become "wasters," and have to be destroyed. There is also a serious loss of condition in the pigs that eventually recover: they are unthrifty and make but little growth for several weeks. It was found that this loss of condition could be avoided largely by administering cod liver oil. In a number of cases, the oil was given to pigs which

had been attacked and had lost condition, and their recovery was very noticeable. Following this observation, the oil was administered as a precautionary measure to pigs which had been exposed to infection; in these cases, the typical diarrhœa developed at the usual times (4-6 weeks and 8-10 weeks) but was quickly thrown off when chalk was fed, the treated pigs showing very little loss of condition. Of 258 diseased pigs which received cod liver oil-chalk treatment, only three were lost. The remainder were all marketed in first-class condition.

The quantities of cod liver oil used were :—

Sucking pigs : 1 dram per head per day.
Weaned pigs, 20-50 lb. live weight : 1 oz. per head per day.
„ 50-70 „ „ „ 2 „ „ „

The sucking pigs were fed away from their dam. The oil was given in all cases in the food, half being given in the morning and half in the evening feed.

Whole Milk.—In one case, whole milk was used instead of cod liver oil, with equally good results.

Separate Feeding of Weaklings.—In many litters which were attacked by disease, one or two small weakly pigs did not do as well as the remainder. These pigs can be reared with their litter mates, but it was found to be a great advantage to sort them out at weaning and to give them a run to themselves. Two or three such pigs put together in a small grass run on all occasions did very well, and several pigs which, otherwise, would undoubtedly have been lost, were saved in this way.

Epsom Salts.—It has been previously noted that pigs which had apparently recovered from the disease suffered from " skin irritation." It was found that this was relieved by an occasional dose of Epsom salts. The simplest way to deal with sucking pigs is to administer the salts to the sows; 2-4 oz. of salts given to the sow will cause the pigs sucking her to purge in 24 hours.

Conclusion.—Every pig-keeper should be familiar with the symptoms of swine fever and should be constantly on the look out for them.

When the " mild form " of swine fever attacks a herd, the following method of procedure is to be recommended :—

(1) Give all pigs a grass run.
(2) Mix meal with water immediately before feeding, and avoid acid foods.

(3) Cull litters at or shortly after birth, destroying weakly and undersized pigs.
(4) As soon as sucking pigs will eat meal, feed them apart from the sow and add one dram of cod liver oil per head per day to their food.
(5) If diarrhœa breaks out in sucking pigs, give the sow 1 oz. of chalk per feed (=2 oz. per day), and continue this until diarrhœa in young pigs ceases.
(6) After weaning, feed 1 oz. of cod liver oil per head per day, ½ oz. being added to morning and ½ oz. to the evening feed. After pigs are 50 lb. live weight, the quantity may be increased to 2 oz. per head per day.
(7) If diarrhœa breaks out in store pigs, feed 1 oz. of chalk per head per day, half in the morning and half in the evening feed, and continue until diarrhœa ceases.*

The disease may be readily spread by the food. The most rigid precautions should therefore be adopted to prevent infected material coming into contact with feeding stuffs.

The writer desires to acknowledge the help he has received from Mr. Willing and Mr. Gooch, the Resident Inspectors of the Diseases of Animals Branch of the Ministry. The former took a very keen interest in the outbreak and, on many occasions, gave valuable advice. Acknowledgment is also due to Professor Cave for help given, both in dealing with the disease and in preparing this article.

* The writer also recommends that ½ oz. of cod liver oil be fed to sows which have been exposed to infection for 14 days before they are due to farrow. The same quantity to be fed after farrowing and continued until the pigglings are feeding apart from the sow. The evidence upon which this recommendation is made is, however, very slender.

* * * * * *

A DEMONSTRATION CIDER ORCHARD IN HEREFORDSHIRE

JOHN F. GOAMAN,
Ministry of Agriculture and Fisheries.

IN the winter of 1908, an experimental orchard was established on six acres of land at the Asylum Farm, Burghill, near Hereford, with the object of testing the relative merits of some of the recognized good varieties of cider apple trees grown in the county of Hereford, and of some of the best varieties grown in other districts but practically unknown to Herefordshire growers. Some of the following particulars about the situation and establishment of the orchard have been taken from a leaflet, prepared in 1909 by Mr. J. O. Peet (then Agricultural Organizer for the County) for the guidance of visitors. The orchard is now used for demonstration purposes by the Herefordshire Agricultural Education Committee.

Site.—The site adjoins the road from Hereford to Canon Pyon, and has a moderate and fairly regular slope with a northern aspect. The soil, derived from the Old Red Sandstone formation, is a good deep loam with the exception of part along the top bank, more particularly at the end next to the road, where it is somewhat stony and of only moderate depth. For several years, the land had been liberally treated. When Mr. Peet prepared his description, it was in good condition and under seeds, sown in 1907, from which a hay crop was taken in the year following.

Trees and Planting.—Twenty-five varieties were planted, 11 of each kind. Each variety occupies a single row, running from top to bottom of the slope, and equal conditions were thus secured for them. The trees were raised at the National Fruit and Cider Institute, Long Ashton, Bristol, and were presented by the Managing Committee of the Institute to the County Council, which had made annual grants to the Institute for some years. When received, the trees were, on the whole, well-grown trees with good roots; the heads were some of one and some of two years' growth.

The square arrangement of planting was adopted, with 30 ft. between the rows each way. Holes about 3½ ft. diameter were opened to a depth of 14 in., and the bottoms forked as deeply as possible, thus breaking the ground to a depth of 20 to 24 in. After the stakes were securely fixed, in holes 3 ft. deep, the turf was chopped on the forked subsoil

and made firm. The hole was then filled to within about 2 in. of the height of the surrounding soil, at which level the trees were planted. All damaged roots were carefully pruned before planting. About 4 lb. of bone meal was mixed with the remainder of the soil, the whole of which was placed about the roots. A mulch of manure was also given as a protection from frost and drought. The stakes used were 2½ in. square in section and 9 ft. long. They were creosoted under pressure before delivery, the creosote penetrating practically to the centre of the stake. The cost, delivered at Hereford, was 9d. each, but to-day's price would be about 1s. 8d.

Tree Guards.—Three types were adopted for the protection of the trees.

(1) A proprietary patent guard consisted of wire netting, 17-gauge, 1¼ in. mesh, 6 ft. high, with six vertical strands of barbed wire. One side is fastened by means of four staples to the stake which supports the tree. The other is then carried round the tree and hooked over eyelets on the fixed side, being held in position by a wire rod running through these eyelets. The makers' price, when purchased, was 2s. 6d. each.

(2) The wire netting for a second type of guard is 16-gauge, 1¼ in. mesh, 3½ ft. wide, and cut into 6 ft. lengths. It forms a cylinder round the tree 6 ft. high, and about 3 ft. in circumference, half a foot being taken up in overlapping. Eight yards of barbed wire are wound regularly round the cylinder from bottom to top to strengthen it and protect it from damage by stock. The cost of the wire netting at the date of planting was 25s. per roll of 50 yards, and of barbed wire 16s. per cwt., but present prices would exceed these.

(3) In the third type of guard, three stakes, similar and additional to that supporting the tree, were used. They were set triangularly with the tree in the centre, a rail at the top and barbed wire below being secured to the stakes, the fence being completed with a narrow cylinder of wire netting. The cost of the stakes, and digging holes for them, made the initial cost of this guard somewhat expensive.

The respective costs of the three forms of protection are given by Mr. Peet as follows, but the prices to-day would be at least 50 per cent. greater :—

Type 1 .	s.	d.
Guard and staples	2	6½
Fixing		1
	2	7½
	3 s 2	

Type 2	s.	d.
Wire netting	1	0
Barbed wire		4
Fixing		1½
	1	5½

Type 3	s.	d.
Stakes (3)	2	3
Setting stakes..		3
Slate battens (3 yd.)		5
Barbed wire (38 yd.)	1	6½
Wire netting (1 yd.)		6
	4	11½

All three tree guards have proved quite efficient, and the cheapest type described is to be desired, therefore, for such work.

Cost of Planting.—The expenses of planting per tree, apart from fencing, were as under, but it should be noted that the figures are for the costs in 1908.

	s.	d.
Opening and filling hole, fixing stake and mulching		5
Stake		9
Bone meal (4 lb.)		2½
Planting		1½
	1	6

Varieties Planted.—The 25 varieties planted were as follows :—

Broad-leaved Jersey	Fair Maid of Devon	Medaille d'Or
Butleigh No. 14	Hereford Redstreak	Old Foxwhelp
Cap of Liberty	Improved Pound	Skyrmes Kernel
Cherry Norman	Killerton Sweet	Somerset Redstreak
Court Royal	Kingston Black	Strawberry Norman
Cowarne Red	Kingston Black Improved	Sweet Alford
Dabinett	Knotted Kernel	Sweet Coppin
Dymock Red	Long Ashton No. 32	Yarlington Mill
Eggleton Styre		

Of the above varieties, a few rogues were found in several sorts and the Dymock Red was not true to type. The French apple, Medaille d'Or, as elsewhere, has proved a complete failure as an orchard tree. Its growth is weak ; it crops heavily and the trees break easily under the strain. This variety, therefore, has been regrafted.

For five or six years, the trees were carefully trained by Mr. A. J. Manning, Horticultural Instructor to the Hereford County Council, during which time they remained in grass.

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Type 1. Type 3. Type 2.

Tree guards used on the Herefordshire Demonstration Cider Orchard.

The orchard was ploughed, however, and carried ordinary tillage crops during the War, and Mr. Manning observed that, as a result of this treatment, the trees made greater growth, and to this chance circumstance is attributed their present satisfactory size. It is valuable as showing that the former practice of establishing an orchard in tillage is still the best method, in certain cases, although very rarely adopted nowadays.

Present Condition.—Recent observation shows that the best trees, true to type, in the orchard are Killerton Sweet, Cherry Norman, Court Royal, Broad-leaved Jersey, Improved Pound, Fair Maid of Devon, Strawberry Norman and Knotted Kernel. The remainder are reasonably good trees with the exception of the following: Butleigh No. 14, Old Foxwhelp, Skyrmes Kernel, Cowarne Red and Medaille d'Or. Of the best trees, only Cherry Norman, Knotted Kernel and Strawberry Norman are Herefordshire varieties. Cap of Liberty, a heavy cropping variety, comes among the weaker growers on a basis of the average girth of the trees; but this average is brought down by several trees on poor ground that have cropped very heavily, but made no strong growth.

Although no crop records have been kept, Mr Manning observes that the order of cropping may be taken to be as follows: Fair Maid of Devon, Cap of Liberty, Improved Pound, Sweet Coppin, Strawberry Norman, Yarlington Mill, Knotted Kernel, Killerton Sweet. It should be noted that the trees are only recently adult. The Somerset and Devon apples show up well compared with the Herefordshire sorts. Cap of Liberty is planted in Herefordshire in places, while Strawberry Norman is commonly met with and Knotted Kernel is fairly common.

The following varieties, from observations made, appear to be fairly resistant to Winter Moth: Cherry Norman, Yarlington Mill, Somerset Redstreak, Dabinett, Knotted Kernel, Strawberry Norman, Improved Pound and Broad-leaved Jersey. While others have, at times, been noted as "clean," occasionally they have had severe caterpillar attacks. As Winter Moth can be controlled, the point is, perhaps, of minor importance.

The three important qualities, from the growers' point of view, are vigour, good cropping and good vintage quality. The varieties, so far as this orchard is concerned, that most nearly fill all these requirements are: Killerton Sweet, Yarlington Mill, Knotted Kernel, Cap of Liberty and Norman. Of these,

only Knotted Kernel and Strawberry Norman are typically Herefordshire apples, although Cap of Liberty is not uncommon in the county.

The orchard, now planted 19 years, is a very valuable object lesson to Herefordshire farmers, and it is to be hoped that more use will be made of the information to be gained from it.

* * * * * *

SALAD VEGETABLES

THE production of salad vegetables on a commercial scale forms a valuable adjunct to market gardening. It is not proposed here to deal with the system of intensive cultivation known as "French gardening," which demands large capital outlay, technical knowledge and experience, but rather to indicate the general practical methods of production applicable to the market gardener, and, in many respects, to the private gardener and allotment holder, to whom some of these crops are invaluable. In fact, the private gardener is usually in a favourable position to grow them; with the greater attention to detail which he can give, a long succession of salads in their best condition can be secured. The allotment holder can utilize spare space between such growing crops as require some time before they need the full room allotted them in normal practice. Most of the salad vegetables are particularly suitable for use in intercropping, as, generally speaking, to be grown rightly they must be grown *rapidly*. From but small areas of land, therefore, a considerable supply of wholesome salads can be obtained.

In order to raise choice crops, the plants need, in practically every case, to be grown quickly and without check, and for this purpose a warm, well-drained soil in "good heart" is necessary, and an unlimited supply of water desirable. In such conditions, and with a certain amount of artificial protection available, salad vegetables may be procured throughout the year. Although they are in greatest demand, and most readily produced, during the summer months, nevertheless, they are sought after and often realize good prices at other periods, when, with a little extra trouble and care, they can be satisfactorily grown.

The plants usually cultivated for salad purposes in this country are:—beet, celery, chicory, corn salad, dandelion, endive, lettuce, mustard and cress, radish, spring onion, and watercress, and also cucumbers and tomatoes. Information on the cultivation of watercress will be found in the Ministry's

Leaflet No. 17, while cucumbers are dealt with in Leaflet No. 123, and tomatoes in Leaflet No. 393.

Beet.—The area of beet under cultivation is not usually large and might be increased with advantage to the grower. The consumption of beet as a salad seems to be somewhat dependent upon the weather conditions of late summer and early autumn. In dull, cheerless periods but little is eaten, whereas in seasons of bright or dry weather, the demand is good. As beet can be suitably stored, the grower can generally avoid forced sales at unremunerative prices and hold the crop in readiness for marketing at a time when economic returns are attainable.

Soil and Manuring.—The most suitable soil for beet growing is a fairly deep, well drained, friable loam, which should be thoroughly worked before planting. It is usual for this crop to follow one that has been well manured, as no fresh farmyard manure should be applied directly to it. A dressing of kainit, at the rate of 4 cwt. per acre, is beneficial.

Seed Sowing, Cultivation, and Storage.—The end of April or the beginning of May is the best time for sowing the seed. Occasionally a small area is put in early in April, but this is only advantageous when it is intended to raise and market an early crop. Plants from early sowings, if allowed to remain till the normal period of lifting, have a tendency either to bolt or to become too large for ordinary purposes. Drills should be made 1½ in. deep and 15 in. apart. This distance between the rows will serve for all except the small type of beet, for which 12 in. is adequate. Sowing should be made as evenly and thinly as is possible without leaving any gaps. As soon as the seedlings are through the soil, the first thinning should be made by striking out redundant plants with the hoe. The second thinning, or singling, must be done by hand at a time when it is certain that suitable plants can be selected to form the crop; these should be left at a distance of 9 in. apart in the row.

If the soil is subsequently hoed frequently in order to produce a surface mulch and prevent the growth of weed seeds, little, if any, further attention is needed. When ready, the crops should be lifted with care, avoiding injury to roots and consequent loss of colour in boiling.

Where storage is desired, a clamp or pit, similar to that used for mangolds, is suitable. The leaves should be carefully trimmed off to within about three inches of the crown before storage. Too close trimming may, however, cause bleeding and inevitable deterioration in the market value of the produce.

Varieties.—For early use, the red turnip-rooted variety should be grown. Main crop sorts are the old Cheltenham Green Top and Nutting's Dwarf, which are still held in favour in many districts. In recent years, the globe variety has been grown extensively. Dell's Crimson and Blood Red are also suitable varieties to grow.

Marketing.—Selected roots are sometimes packed in flats, with other salad vegetables, but the more usual method is to sell by weight or the dozen. In any case, roots should be washed clean of soil and graded into sizes and not sold "as grown." Attractive packs can be made in three grades, each consisting of large, medium or small roots. Where roots are sent by rail, judicious use of hay in packing prevents injury and resultant loss through bleeding.

Diseases.—The beet is occasionally attacked by Crown Gall and by a form of Scab similar to that occurring in potatoes. Both troubles are contracted from organisms in the soil and neither can yet be cured. The crop should not, therefore, be grown in soil liable to carry these diseases. The leaves are sometimes affected with "Rust" for which, again, there is no known cure, but lack of potassic manures is said to favour the incidence of this disease. Stored beets sometimes suffer from "heart" or "dry" rot, said by some to be due to the attacks of the fungus *Phoma betae*. In making clamps or pits, care should be taken to exclude roots that are affected, and attention should be paid to drainage and ventilation so as to avoid "heating" and yet run no risk of frost.

Celery.—Celery is in general demand during the autumn and winter months. Whilst, admittedly, good-quality produce is costly to grow, it has been proved, by the remunerative prices realized for it, that such expenditure is justified. Poor-quality celery, on the other hand, is seldom a paying proposition. It has been found possible, however, in recent years, by selecting a suitable soil and aspect for the crop, to eliminate some of the labour items, such as watering, which were formerly deemed to be essential points in its cultivation.

Soil and Situation.—Celery is best grown in an open position. The soil should preferably be a deep, rich, medium loam. A heavier type of soil is not unsuitable, provided it is rich in organic matter and has an adequate supply of moisture in movement. Certain soils in the Fen districts of Lincoln

and Cambridge are admirable for the purpose of celery growing.

Sowing the Seed and Treatment of the Seedlings.—To obtain early crops, thin sowings, in shallow boxes of prepared soil, should be made in mid-January. The soil used must be porous, finely sifted, and pressed firmly in the boxes. For this early sowing, any available heating resources of the grower should be employed to supply the necessary warmth, a heated greenhouse being most suitable. When the seedlings are large enough to handle, they should be pricked out in boxes containing equal parts of loam and leaf mould, made porous by the addition of sand. The seedlings should be planted diagonally at a distance of 1½ in. Such plants, after pricking off, should be placed near to the glass in order that sturdy growth may be promoted and the production of spindly, drawn-out plants prevented. If carefully attended to, these plants will require further transplanting in a short period, and the best site will be a frame which has been made up on a slightly heated hot-bed. The surface of the soil in the frame should be within 8 in. of the glass, and the plants should be given 2½ in. of space each way. Attention to watering and ventilation is essential; after the plants have become established, the lights may be lifted off, except during cold nights—the object being to harden the plants and obtain sturdy growth before planting them out in the open in rows or beds about the second week in May.

For later batches, sowings may be made in February and March on hot-beds protected by frames. These will provide plants for final bedding at intervals during June and July. Less attention will be needed in the pricking off than for the January seedlings—they may be planted direct from the boxes to frames and set out at a distance of 2 in. apart.

Cultivation.—Celery may be planted in rows or beds, although the latter method is not generally adopted on account, possibly, of the large amount of spade work involved. If it be decided to plant out in single rows, trenches 1 ft. wide and 1 ft. deep should be made. The distance between the rows should be 4 ft. Manure should be spread in the trenches to a depth of 6 in. and covered with soil which, when made firm, should be 3 in. deep. For double rows the trench should be 2 ft. wide, with the same depth and manner of filling as for the single row. In single rows, the plants are set 9 in. apart, whilst for double rows, 9 in. from plant to plant

and 12 in. from row to row will be necessary. In double rows, planting is done diagonally.

For the bed system, the land is marked out 10 ft. wide. A few inches of the top soil are removed and banked up on a space 3 ft. wide outside the marked area. Thus, for a series of beds, a space of 10 ft. is allowed for each with a 3 ft. space between. The bed area is dug over, well manured, and celery planted out diagonally 9 in. apart.

In either system, the spaces between the rows can be utilized for catch crops, such as lettuce, radish, and such salads as can be readily cleared before the earthing-up of the celery is necessary.

In seasons of drought, an occasional watering may be necessary. When the plants have made one foot of growth, the first earthing-up should be done. For the early crop, which it is intended to market in mid-September, earthing will usually be effected early in August. The plough may be used for this and the second earthing, but the final one should be done with the spade. Soil must be prevented from getting into the heart of the plants and causing decay; it is therefore imperative to ensure that the stems are close together and the leaves well up. The earth should be drawn around each plant and made firm. Much care should be exercised in the final earthing-up. Upon this depends the effective blanching of the celery, and therefore the appearance and quality of the mature plants.

Varieties.—The following are suitable varieties to grow:—

White varieties: Sandringham, White Gem, and Solid White.

Red varieties: Leicester Red, A 1, and Clayworth Prize.

White varieties are usually preferred for all purposes, and exclusively for early work; for the latter, Sandringham and White Gem are favourites.

Marketing.—Celery is usually sold in bundles of eight or a dozen sticks, these being made up either in flats, known on the market as "Fans," or else in round bundles, called "Rolls." The outer leaves and roots should be removed and the stems washed, so that the fans or rolls present a clean, attractive appearance.

Pests and Diseases.—The two most serious insect or animal pests are the Celery Fly (see the Ministry's Leaflet No. 35) and various kinds of slugs (Leaflet No. 132), while occasionally the Carrot Fly (Leaflet No. 38) is troublesome. The leaflets

dealing with these pests should be consulted for detailed information, but the following are the more important points :—

CELERY FLY.—The planting-out of the infected seedlings should be avoided as it will almost certainly result in damage to the crop later. If the plants become infected when in the seed bed or in boxes, it will usually be found at planting time that the outer leaves alone are attacked, and such leaves can be pinched off and burnt. Deterrent sprayings with paraffin emulsion, or dustings with soot and lime, are chiefly of service in the case of small areas, since they are only effective if repeatedly carried out.

SLUGS.—The attempt to grow celery commercially on slug-infested land is not worth while. In the case of small garden plots, wrapping the stems in brown paper just before earthing-up will prevent much slug damage.

CARROT FLY.—If this pest becomes troublesome to those who grow celery on a commercial scale, it is advisable to avoid planting celery on or near land which has carried a carrot crop the previous season.

CELERY LEAF SPOT is important. This disease is dealt with in Leaflet No. 238. It should be emphasized here that the disease arises mainly from sowing infected seed, and special care therefore is necessary in obtaining clean seed. If this cannot be obtained, the seed should be disinfected, as indicated in the Leaflet. Subsequent spraying when necessary should be counted as the price to be paid for the folly of not securing proper seed.

Chicory.—The blanched leaves of the chicory plant (*Cichorium intybus*) are used for winter salad purposes in this country. A deeply worked loamy soil, which has been well manured for a previous crop, is desirable. It is not good practice to apply farmyard manure to soil immediately before planting.

General Cultivation.—Seed should be sown about mid-June, in drills 1 in. deep and about 1 ft. apart. When the seedlings are about 2 in. high they must be thinned, leaving the plants 9 in. apart in the row. For the remainder of the summer, it is only necessary to keep the soil stirred and free from weeds by frequent hoeing. The roots should be lifted in the autumn and the leaves *twisted* off, the roots being stored in the same manner as for beet, till they are required for forcing.

Forcing and Blanching.—The root can be forced in a variety of places, such as pits or cool greenhouses, or a warm shed.

Early Crop.—A crop can be obtained in the spring of the year by two methods, according to the facilities of the grower :

(*a*) Seed of a hardy variety may be sown during August or early September, the seedlings being wintered in frames or on a protected border. Drills should be drawn 4-5 in. apart, the seed sown thinly, and lightly covered with soil. The plants should be set out in their final bed 9 in. square, being transplanted to these when they are large enough to handle.

(*b*) Seed of a quickly maturing variety may be sown in a heated house in January. When this method is adopted, it is the practice to sow in shallow boxes, covering the seed with fine, sifted soil, care being taken to ensure thin sowing. As soon as large enough, the seedlings may be pricked out into other boxes, placing the plants about 4 in. apart in both directions, or, if more convenient, they may be planted direct into the border of an early tomato house. Some of those pricked into boxes may be gradually hardened off and others planted in cool houses or final quarters outside to provide a succeeding crop.

In the cultivation of lettuce under glass, forcing must be avoided, otherwise they will not " heart " properly. Further sowings may be made under glass for succession until the summer crop is ready, the treatment varying as the season advances.

Summer Crop.—Small sowings at regular intervals are desirable for the summer crop. The first may be made about the middle of March and others at intervals up to the end of June. The resultant seedlings should be transplanted as they become large enough to handle. A number may be allowed to mature where sown, in which case thinning to the required distance must be effected. The thinnings, if carefully lifted, can be planted elsewhere to come in as a later batch. Constant hoeing is essential, and, in a very hot season, mulching is sometimes resorted to, with beneficial results.

Winter Crop.—Seedlings of the hardy varieties, sown as for the spring crop, will, if the season be favourable, be fit for use during the winter. Such seedlings should be lifted and planted out to finish in a cold frame, where they will be protected in the hardest weather.

Manures.—Little manure need be applied to lettuce if planted on land where the previous crop was well dunged, but, failing this condition, a dressing of well-rotted stable or farmyard manure at the rate of 10 tons per acre should be given. If, however, these natural manures are scarce and the

soil is deficient in humus, or where green manuring has not been resorted to, artificials may be used. As a spring dressing, superphosphate of lime at the rate of 5 lb. per pole is advised, and sulphate of potash at the rate of 3 lb. per pole often gives good results. Sulphate of ammonia is best applied when the crop needs a little stimulating to promote "hearting." On the lighter soils around industrial centres, where continuous cropping is practised, the land is likely to be deficient in lime, and growers should therefore make sure that the soil in which a lettuce crop is to be grown is adequately supplied with it.

Varieties.—There is a large number of excellent varieties of cos and cabbage types of lettuce. The names of a few of these are given below, but growers should largely be guided by local experience in the selection of suitable kinds for their purpose :—

FOR SPRING CROP : *Cabbage.*—Golden Ball ; Stansfield Park ; Continuity ; Commodore Nut ; Tom Thumb.
Cos.—Hick's Hardy White ; Parish Green.

FOR SUMMER CROP : *Cabbage.*—Ideal ; Wonderful ; Malta.
Cos.—Parish White ; Superb White ; Mammoth White ; Covent Garden White.

FOR WINTER CROP : *Cabbage.*—Hammersmith Hardy Green ; All-the-year-round ; White Chavigne.
Cos.—Black Seeded Bath ; Winter Green.

Marketing.—Summer lettuces are usually pulled and sent to market with the roots attached ; the cos varieties should be tied before dispatch, as this prevents the outer leaves breaking during transit and preserves them in good shape and neat appearance. Winter and spring produce, especially when scarce, pays for packing in small flats ; the cos varieties should be laid on their sides and packed closely together, the cabbage sorts with hearts uppermost. In all cases, the grower should endeavour to arrange for the dispatch of his lettuces as soon as pulled, in order that they may arrive on the market in fresh condition. Attention to attractive and clean methods of packing will usually yield a profit on the trouble taken to ensure them.

Pests and Diseases.—All pests which are general feeders, such as Cutworms and Leather Jackets, attack lettuce, but, as the crop seldom justifies special treatment, it is necessary to rely for the control of these pests upon cultural measures, especially the repeated hoeing and working of the soil, which forms part of the regular routine on the soils usually preferred for a lettuce crop. Lettuce Root Aphis is sometimes

troublesome, but no control measures are known. Under glass, Aphides (green fly) on the foliage may also cause injury if allowed to persist until hearting begins. Fumigating or spraying the plants when still young should prevent this damage.

Lettuces are sometimes attacked by a Downy Mildew when grown under conditions of excessive atmospheric humidity, and precautions should be taken to avoid such conditions. The Ring-Spot disease of this crop is often very serious, both under glass and out of doors. (See article in this JOURNAL, May, 1923, p. 147.)

Mustard and Cress.—Seedlings of these plants are usually sold together for use in salads, and, their cultivation being so simple and similar, need not be treated separately.

Mustard usually germinates more rapidly than cress and should therefore be sown about three days later than cress. Although during summer the plants are hardy, it is nevertheless advisable to grow them only under cover, in partial darkness, as the seedlings are then crisper and taller and the stems white, whereas in the full light they are apt to be somewhat short and green.

Seed is best sown in boxes containing friable, sifted soil. After watering thoroughly, the seed is sown on the surface of the soil and allowed to grow to a height of 1½ inches. Cutting should be done with a long sharp knife and the produce packed tightly in punnets, with heads uppermost.

Varieties.—White mustard is generally used for garden crops, but for commercial growing black is often sown.

For cress, the type known as "garden cress," is used.

Radishes.—Radishes are by no means difficult to grow, and, as an early crop, are generally profitable. It must, however, be borne in mind that a good sample can only be obtained when rapid growth, without a check from seed bed to maturity, is secured. One common error is the sowing of too large a batch at one time, so that, if the roots cannot be disposed of as they become fit for market, they soon get hollow, pithy and, consequently, unprofitable.

Cultivation Outdoors.—The date of the earliest sowing will depend on the soil available and the methods adopted. In a favourable season, the first sowing may be made towards the end of February. A rich, deeply dug, friable soil, containing plenty of lime, is most suitable; heavy retentive soils should be avoided. The seed bed should be moderately dry and possess a fine tilth.

Seed is often sown broadcast, but it is more economical to sow in drills 9 to 12 in. apart, and thin out the seedlings to 1½ to 2 in. apart in the drills. If late sowings are made during hot weather, a shaded site should be selected. Throughout the summer, frequent hoeings are necessary. Each crop should be ready for pulling in a few weeks.

Where plenty of cheap straw is obtainable and conditions admit the formation of a suitable bed, sowings can also be made at intervals commencing in late December. Beds 6 ft. wide, in sheltered positions slightly raised above the level of surrounding ground, with pathways between, are generally made for this method of culture. The seed is sown in the beds, lightly covered with soil, and the area covered with straw to a depth of 6 in. During favourable spells of weather, the straw should be raked off into the alleys. After germination of the seed, the straw covering should be in place only during frost or cold spells.

Cultivation in Frame or House.—Early crops can be secured by making sowings in December and January on a gentle hot-bed, covered with about 6 in. of good soil, over which is placed a frame, so arranged that the soil is only a few inches below the glass. The seed should be sown in drills, watered with tepid warm water, and the frame kept closed till the seed germinates. After germination, the frame should be opened when the weather is favourable, and, in due time, the seedlings thinned. Another means of producing early crops is by sowing in borders in houses which are, later, to carry a tomato or other crop.

Whichever method is pursued, it is well to bear in mind that failures with this crop are often due to sowing the seeds too thickly and not thinning sufficiently after germination.

Varieties.—For early sowings, the olive-shaped types are most suitable, although Wood's Early Frame is still used in some districts.

For summer crops, the turnip-rooted varieties give the best results.

Marketing.—After pulling, the roots should be washed, and put up in bunches of 12. Even-sized and shapely radishes only should be marketed. The long rooted sorts are sometimes arranged fanwise. They are sold in units of one dozen and one score bundles.

Pests and Diseases.—Flea Beetles are troublesome in dry weather (see Leaflet No. 3).

Radishes occasionally suffer from a Downy Mildew and from White Blister, but these diseases are rarely serious enough to necessitate spraying with Bordeaux Mixture. Finger-and-Toe sometimes occurs in radishes (see Leaflet No. 77).

Spring Onions.—There is a considerable demand for "spring" or "green" onions for use in salad, and, in the past, large areas around Evesham and in other localities have been devoted to the production of this crop.

Seed is sown for preference in August. In the north, sowings are made early that month, but, in the southern counties, the end of August is a suitable time. The land should have been dunged for the preceding crop, but at this stage it is not necessary to work it deeply. A fine tilth is essential, however, and a firm seed bed desirable. The seeds should be drilled at a distance of 12 in. between the rows. Onions are often sown as a catch crop between rows of other crops. At all times the beds should be kept clean, and a frequent use of the hoe between the rows will not only prevent the growth of weeds, but will also assist the growth of the crop. It is desirable to get the produce on the market as early in the season as possible, and a light dressing of either sulphate of ammonia or nitrate of soda may be given in February, and the hoe used between the rows, provided that the soil is sufficiently workable or dry.

When a suitable size has been attained, the plants may be marketed in bundles containing one dozen onions which have been washed free of soil. In many markets, the bundles, up to 12, are generally tied together.

The thinning from spring-sown onions, where grown for "large onions," are also marketed for salad purposes, and in some districts the trade done is considerable.

White Lisbon is usually grown for this type of work, but other suitable varieties are A 1 and Giant Rocca.

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POULTRY ON THE GENERAL FARM

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THE object of this paper is to suggest to the general farmer a method of poultry-keeping which he can conveniently and profitably carry out, with the minimum amount of initial capital outlay, and without interfering with the general conduct of his other farming operations.

The first question which the farmer will naturally ask is: "Is there room for expansion of the poultry industry in this country, or shall we, if many of us take up poultry-keeping more extensively, bring about over-production and consequent reduction in the possible profits to ourselves?" This question is completely answered by a study of the Reports* on the Marketing of Eggs and Poultry which have been issued by the Ministry of Agriculture. These reports show that approximately £20,000,000 are annually paid to foreign countries for eggs and poultry imported into this country to supply the present demand. The annual increase in imports shows that the home demand is not likely to decrease, but is much more likely to increase. No fear need, therefore, be felt as to a possible lessened demand for poultry produce in the future.

There is no doubt that the cost of production of eggs and poultry is lower in the case of the general farmer than in the case of the producer who is a poultry farmer pure and simple. In the latter's case the whole of his land is entirely stocked with the poultry, which provide his sole source of income.

The General Farmer's Advantages.—There are numerous reasons why the general farmer is in a position to produce cheaply, but the chief of them may be stated briefly as follows:—

(1) He is not bound, as is the case with the poultry farmer, to stock his land heavily with poultry with the consequent risk of the land becoming poultry sick, thereby impairing the health of his birds and making them more susceptible to diseases of a serious nature. He can use fresh ground annually for his chicken-rearing area, this in itself going a

* *Report on Egg Marketing in England and Wales*, Economic Series No. 10, price 6d., post free 9½d. *Report on the Marketing of Poultry in England and Wales*, Economic Series No. 11, price 6d., post free 9d. H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

long way towards the successful conduct of this branch of the poultry work.

(2) It is possible to run a certain head of poultry on grass land without detriment to the other farming stock and without decreasing the numbers of the latter which the farmer is accustomed to run per acre. This is accounted for by the fact that poultry have a small food capacity and therefore require concentrated foodstuffs. This small food capacity does not allow of their consuming any appreciable proportion of the grass which is needed for the other farm stock. The chief source of food for poultry, so far as the grassland is concerned, is the animal life which they consume in the form of worms, slugs, grubs, insects, etc., these, in many cases (*e.g.*, wireworms) being harmful to the growth of the grass itself. The foodstuffs which are hand-fed to poultry are of a highly concentrated nature, and hence the manurial value of the residue from this source is considerable, and the land over which the poultry run benefits by receiving a highly nitrogenous manure—this, in its fresh state, being at least equal in value to the highly-priced artificial manures sold in the form of guanos.

The fact that poultry can be run in addition to the ordinary farm stock means that the profit-earning capacity of the land per acre is increased without addition to the rent or rates. Virtually, the general farmer can regard poultry as living rent free on his farm.

(3) The farmer can produce a certain proportion of the foodstuffs necessary for the poultry, thus eliminating millers' profits, cartage, and other labour charges on these particular products. Wheat, oats, tail corn, straw for litter, etc., are all produced on the farm, and all can be used in part for the poultry.

(4) The land, so far as the poultry are concerned, is practically unlimited, so that it is possible to run the birds in small flocks, widely separated from one another, and no wire netting fences are required. This eliminates a considerable item of capital outlay which the poultry farmer must, of necessity, incur in order to keep his flocks within his own boundary and to prevent mixing and crowding in the houses.

(5) As poultry, on the general farm, have practically unlimited free range over grassland, they cost the general farmer less to feed than the poultry farmer, since, at certain times of the year, they will be able to obtain a large amount of natural food which does not cost anything. The fact that they are

only run on the farm in comparatively small numbers per acre gives them greater opportunities of obtaining this cheap but very valuable form of food.

(6) The general farmer is saved the cost of applying expensive heavy dressings of basic slag, lime, etc., which the poultry farmer must necessarily use in order to prevent his land from becoming poultry sick.

(7) Pullets can be run on the corn stubbles for some considerable time after harvest until the shed corn has all been picked up, after which they are drafted into the laying-houses. Cockerels for killing as table birds can also be run on the stubbles. This all helps to reduce the cost of production, and is greatly to the advantage of the farmer when compared with the poultry farmer.

As an instance of the indirect value of poultry to the farmer, the case of arable land badly infected with wireworm may be taken. Such land can be largely, if not completely, cleared of this pest by temporarily stocking the infected fields with poultry during ploughing and other tillage operations, provided not more land be ploughed at one time than the number of birds can adequately cover. As a general guide, 400 birds will do an immense amount of good if one acre a day is ploughed for them.

Number of Birds per Acre.—On grassland, the maximum number of birds should not exceed 50 per acre. Even with this number, it will be found that the same number of other farm stock can still be kept on the land. It is not suggested, however, that the farmer should attempt so large an undertaking as to carry 50 birds per acre on all of his grazing land, but rather that he should aim at a flock total which can be adequately looked after by one man, these being evenly distributed over his total grazing land. For example, a farmer having 100 acres of grazing land would run his poultry at the rate of approximately 10 birds per acre, if his total flock numbered 1,000 birds.

Size of Flocks and Houses.—The most economic unit is one of 120 to 150 birds in one house, each house having 300 sq. ft. of available floor space. For example, a house 24 ft. long by 12 ft. wide would house approximately 150 birds. The houses must never be less than 80 yards apart, or mixing and crowding of the flocks will take place. Such close proximity would be unlikely as, at this distance, the number of birds would be approximately 85 per acre.

The size of house mentioned (24 ft.×12 ft.) allows only two square feet of floor space per bird, which is the absolute minimum area if the birds are to have the necessary scratching exercise, obtained by feeding grain in dry straw litter inside the house during bad weather. This size of house is only capable of housing 150 birds when both top and bottom ventilation is provided in such a way as to allow frequent change of air without causing draughts.

One-Man Unit.—It is suggested that the total head of adult stock should be such that it justifies the employment of a full-time poultryman. Provided certain simple labour-saving devices are used, one man can look after 1,000 head of adult stock housed in flocks of 150 birds each, and can rear 1,000 to 1,200 chicks each season. It is, however, advisable to have someone on the farm who can, at a moment's notice, take the place of the poultryman in case of illness, and so that he can have at least one half-day off duty per week.

Making a Start.—It is suggested that the poultry section of a general farm should be the particular care of one of the farmer's sons (if he have one) who has been specially trained for this work at one of the Colleges or County Institutes which provide facilities for such training. It is not suggested, however, that this trained son should immediately launch out into a 1,000-bird plant, but rather that he should start gradually, feeling his way during his first year, commencing in October, by building his chicken-rearing appliances. This would be followed by rearing some 600 to 700 chickens, and by building two laying-houses which should be ready by the end of August for the 300 pullets which he should get from the 600-700 chickens hatched. The following year he would extend by building more laying-houses and rearing more chickens. By extending gradually in this way he will gain invaluable practical experience and the confidence that will lead to success.

If hired labour has to be used, then the problem becomes rather more difficult, as the farmer himself will have to give up a certain amount of time to the supervision of the poultry branch.

Labour-Saving System.—In order to reduce labour to a minimum, the dry mash method of feeding should be adopted, each house being provided with dry mash hoppers of sufficient capacity to supply the birds for a week. In each house there

should be a metal bin which will hold a week's supply of grain, and all the houses should be fitted with rain-water gutters leading to two 40-gallon creosote barrels raised on a stand outside the house and, in turn, connected with a ball tap and drinking trough inside the house. Creosote barrels are suggested because creosote is used for the houses and therefore it is probable that some of these will be available on the farm. By this method of collecting the rain water from the roofs of the poultry-houses, the water supply is guaranteed for the greater part of the year and an immense amount of labour is saved. During a period of drought water will, of course, have to be carted round in a water-cart.

Each house should also be provided with a galvanized dust-bin, outside the house, to take the manure which is scraped daily from the dropping-boards under the perches.

A cart would visit the houses once a week to deliver dry mash, grain, grit, shell, straw for litter, etc., and at the same time would empty the manure-bins, carting the manure to a shed where it would be stored under cover to prevent loss of manurial value through exposure to rain. It is recommended, however, that this manure should be distributed as soon as possible, as, if left for long in heaps, it heats and loses much of its fertilizing value.

The above system makes it possible for the poultryman to attend to a far larger number of birds widely distributed over the farm than he could possibly attend to had he to carry by hand all water, foodstuffs, etc., several times a day. The houses need fencing round to keep other farm stock from damaging them but, other than this, no fencing is required.

Shutting Up at Night.—Under this system of free range poultry-keeping, it is of course essential that the houses be all closed up at night to prevent losses by foxes. In districts where foxes are so numerous as to cause loss by day this system cannot be carried on successfully.

The Stock.—The success of the whole scheme, of course, depends upon (1) the stock, (2) the feeding, and (3) the housing and general management. Since the main source of income will be from the eggs produced, it is essential that stock of the "bred-to-lay" type be used and not the purely exhibition type. Breeders of the "bred-to-lay" type can be found by carefully watching the monthly reports of, and by paying a visit to, the local County Egg-Laying Trials or the larger Open

Laying Trials. It is not, however, proposed that the farmer should necessarily purchase his stock from the winners of these trials, but rather that he should purchase from breeders whose birds have consistently done well over a period of years.

It is realized that, in most cases, the farmer cannot spare the time to be a pedigree breeder of poultry, since this necessitates trap-nesting, much recording and other work. The simpler method is for him to purchase either hatching eggs or day-old chicks from the pedigree breeder and rear the chickens himself. He should be able to purchase hatching eggs at £3 per 100 or day-old chicks at £6 per 100, which will give him stock capable of putting up a paying egg average. In estimating the number of eggs required for hatching it is wise to allow five eggs for every pullet required.

Culling the Flocks.—It is not profitable to keep the average layer for more than two laying seasons, therefore half the flock will have to be culled and sold as fat hens annually, and a corresponding number of pullets reared to replace them.

Capital Outlay.—The amount of capital required, per adult bird, should not exceed 20s. This capital may be apportioned approximately as follows :—

	Per bird.	Per 1,000 birds.
Stock	7s.	£350
Housing	8s.	£400
Rearing appliances	4s.	£200
Sundries	1s.	£150
Total	20s.	£1,000

Returns.—A flock consisting of 50 per cent. pullets and 50 per cent. hens, none of which are kept for more than two laying seasons, will easily produce an average of eleven dozen (132) eggs per bird per annum. These, at an average price of 1s. 10d. per dozen, will bring in a gross return of £1 0s. 2d. per bird per annum.

Expenses.—The following is an apportionment of the expenses which will have to be incurred :—

Foodstuffs	10s. 0d.	per bird per annum
Labour	2s. 3d.	,, ,,
Replacements (stock) ..	3s. 0d.	,, ,,
Depreciation (plant)	1s. 3d.	,, ,,
Sundries	2d.	,, ,,
Total ..	16s. 8d.	,, ,,

Net Profit.—The above figures, based upon a comparatively low egg average, show a net profit per bird per annum of 3s. 6d., or £175 on 1,000 birds, which is 17½ per cent. interest on the capital invested.

Payment of Labour.—In the event of hired labour having to be used it will be noted that, in the statement of expenses, the labour item is put at 2s. 3d. per bird per annum. This, based on the fact that a flock of 1,000 birds is a one-man job, works out at an annual wage bill of £112 10s. 0d., or approximately 43s. per week. It is, however, suggested that a fixed weekly wage of 35s. be paid, and that the remainder be made up in the form of a bonus of fourpence per hundred eggs produced. This bonus would be paid weekly, but a single annual bonus is suggested of 20s. per egg for each egg by which the average of the whole flock exceeds the 132-egg average mentioned under the heading "Returns."

Disposal of Surplus Cockerels.—The above profits do not take into consideration possible profits from the sale of surplus cockerels. For every pullet raised, there will be at least one cockerel to be disposed of. Whether there be any profit on the sale of these will depend, firstly, upon the breed kept, and, secondly, upon the method of preparing them for market. If a light breed be kept, only the earliest hatched cockerels will show a profit. On the other hand, if a heavy breed be kept there is no reason why at least sixpence per head net profit should not be obtained. If these cockerels be sold alive straight off the run, and marketed in the local auction yard, no extra labour expense will be incurred, but the price realized will not leave so much profit as would be the case if the birds were partially fattened, killed, plucked, and marketed in one of the London wholesale auction markets. Table birds, to realize the best prices on the London market, must be young and well covered with soft flesh. This can only be obtained by penning the birds in fattening cages and feeding on meal and sour separated milk mixed to the consistency of thick cream and fed in troughs. This treatment, for from seven to ten days, greatly improves the quality of the flesh and increases weight. The important point, however, is that although the increase in weight may not be considerable, the improvement in the quality of the flesh results in a better price per lb. than in the case of the birds sold straight off the run and marketed in the same way. These surplus cockerels

should be sold at from eight to eighteen weeks old, according to the market requirements. The demand for the smaller birds is greatest in the earlier part of the season, the size required increasing as the season progresses. In no case should the cockerels be kept until they become coarse and show spurs, as in this condition they always realize a poor price.

Effect of Poultry on Grassland.—The beneficial effect of keeping poultry on poor chalky grassland has been clearly demonstrated on Wye College farm. By feeding most of the grain feed in the coarse, rough patches, the coarse grass has been largely scratched out as, also, has the moss on other parts of the field. These changes have been brought about in a comparatively short period (two years) owing to fairly heavy stocking (75 birds per acre), but there is no reason why similar results should not be obtained with less heavy stocking but extending over a greater period. The writer knows of many instances where this has been the case.

Poultry in Orchards.—The scheme of poultry keeping as outlined above can be applied equally well by fruit growers in their orchards. It is very important, however, that fallen fruit should be picked up daily to prevent the poultry from eating it. When poultry eat large quantities of fruit, especially apples, bowel trouble very soon sets in and causes much trouble. This is especially so in the case of growing chickens, and therefore particular care to collect windfalls must be taken where chickens are being reared.

Considerable advantage to the fruit grower is obtained by running poultry in his orchards as a means of destroying certain kinds of pests which attack the fruit. This is in itself an indirect source of income attributable to the poultry.

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METEOROLOGY AND AGRICULTURE

A THIRD conference arranged by the Ministry between workers engaged on the study of various aspects of the effect of weather on crop growth was held at the Meteorological Office on September 22 and 23, 1927, under the chairmanship of Sir W. Napier Shaw, F.R.S. Those present included representatives from the research institutes at Rothamsted, Cambridge (Animal Nutrition), East Malling (Fruit Growing), Aberystwyth (Plant Breeding), and Edinburgh (Animal Breeding), from the crop testing stations in England, and from several agricultural colleges and county agricultural staffs.

The following papers were read :—

"The Week as a Phenological Time Unit" (Sir W. Napier Shaw).

"Rothamsted Temperature Records" (Mr. T. N. Hoblyn, Rothamsted Experimental Station).

"The Effect of Temperature and Humidity on the Changes in Weight of Crops in Storage" (Mr. H. J. Page and Mr. G. V. Jacks, Rothamsted Experimental Station).

"Investigations into the Losses that Occur in Corn Crops During Storage in the Stack" (Mr. W. S. Gibson, East Anglian Institute of Agriculture, and Dr. W. Goodwin, South-Eastern Agricultural College).

"The Effect of Temperature on the Keeping Quality and Bacterial Count of Milk" (Captain H. Barkworth, South-Eastern Agricultural College).

"The Effect of Meteorological Conditions on the Amount and Nutritive Value of Pasture and Hay" (Professor R. G. Stapledon, Welsh Plant Breeding Station).

"The Effect of Meteorological Conditions on the Rate of Growth of Pasture Grass" (Dr. H. E. Woodman, Cambridge Animal Nutrition Institute).

"Temperature and the Food Requirements of Animals" (Professor T. B. Wood, Cambridge Animal Nutrition Institute).

"The Effect of Ultra-Violet Light on Animal Nutrition" (Dr. H. E. Magee, Rowett Research Institute).

"Meteorological Factors Affecting Sheep" (Mr. J. E. Nichols, Edinburgh Animal Breeding Research Department).

Space does not permit of a full account of these papers, some of which are in any case rather of academic than immediate practical interest, but a brief summary of each is given below. It is proposed later to issue a full report of the conference, and a limited number of copies will be available for free distribution.

The Week as a Phenological Time Unit (Sir W. Napier Shaw).—In so far as the application of meteorological data to agriculture or phenology is concerned, the week is a much more convenient unit of time than the month. The salient

events of a week, meteorological and phenological, would not be missed by anyone making a weekly round of observation, whereas the conditions at the beginning of a month may be only dimly remembered by the end of it. The common events of ordinary life also are periodic in the week and are likely to remain so as long as the " week-end " habit holds. For the practical application of meteorological statistics, therefore, the week is a natural unit. This unit was chosen for a Report of the Meteorological Office specially designed for agricultural and hygienic application. A novel feature of this weekly series of data is that warmth and cold are not dealt with by the simple process of noting temperatures but, at the suggestion of leading authorities in agricultural science, by " accumulated temperature " above or below 42° F., expressed in " day degrees."

The weekly report of the Meteorological Office affords the best material for the study of the features of climate in relation to its effect upon the sequence of events in agriculture, or the facts concerning health and disease, which are set out week by week in the tables of the Registrars-General of the three Kingdoms. The weekly records can easily be summarized to preserve in very short form for the community in general an effective memory of past weather.

Data given suggest that, for the purposes of a weekly report, it is well to commence the statistical year on January 8, to group the weeks in fours and fives, which by analogy may be called months, so arranged that the four groups of five weeks have the solstices and equinoxes in their middle weeks. The grouping makes it easy to display the quarters of the May-year and the seasons of the Farmer's year—autumn, winter, spring, and summer.

Rothamsted Temperature Records (T. N. Hoblyn).—Daily records of maximum and minimum temperature have been taken at Rothamsted for nearly 50 years, and it has been found necessary to condense the mass of data which has accumulated into a form which would be more easy to handle before an adequate consideration of the effect of temperature upon any particular agricultural or horticultural crop could be attempted. During the process of condensation, it was realized that the effect of temperature would be most evident in its variations, either from day to day in any one particular year, or in the variations of the mean for a particular month from year to year. The daily readings were, therefore, reduced

to five constants for each month. These were, firstly, the mean for each; secondly, the variation of each measure during each month; and, thirdly, the co-efficient of correlation between maximum and minimum.

The variation over a period of years can be divided into two portions, that within months and that between the same months in different years. The analysis showed that the greatest variation of the maximum temperature is found in the spring and early summer, the winter being comparatively even; the minimum temperature, on the other hand, varies greatly in the winter months, while the summer months are very even. It would appear, then, that maximum temperature is likely to have a decided influence on an annual crop during the spring and early summer, while the minimum temperature is most likely to have an influence during the winter and early spring. The variation of the mean temperature during the summer months is greatly influenced by the low variation of the minimum; the mean tends, therefore, to give a poor idea of fluctuations of temperature during this time.

Considering now the variation between the same months in different years: whereas, in the spring and autumn months, the variation of the maximum temperature within months is high, the mean maximum temperature varies comparatively little from year to year. In the winter and summer, however, the maximum varies very considerably between years.

The minimum temperature has its greatest variation from year to year in the winter, but is extraordinarily constant in the summer months. Whether a summer be hot or cold, there will be very little difference in the minimum temperature in either case.

The mean of the maximum and minimum probably gives a fair idea of the variations in temperature from year to year in the winter months, but the mean tends to follow the maximum temperature from year to year during the summer months.

The Effect of Temperature and Humidity on the Change in Weight of Crops in Storage (Mr. G. V. Jacks).—Experiments have been carried out at Rothamsted on wheat, oats and barley with the object of ascertaining the effect of controlled conditions of relative humidity, temperature and pressure on the weight of crops during storage. Preliminary experiments on oats having indicated conclusively that variations of

pressure had no appreciable effect on the moisture capacity of the grain, the main work was confined to temperature and relative humidity.

Temperatures of 50° F., 59° F., and 68° F., and relative humidities of 60 per cent., 75 per cent., and 90 per cent., were used. It was found that the humidity changes had a much greater effect on the weight of the crops than had the changes in temperature. All three crops lost weight at 60 per cent. and 75 per cent. relative humidity, and gained weight at 90 per cent. relative humidity. The way in which temperature changes affect the moisture relationships depends on whether the crop is gaining or losing water. Where the crops have lost weight, the *loss* is greatest at the highest and least at the lowest temperature. Where the crops have gained weight, the gain is greatest at 68° F. and least at 50° F.

Analysis showed that the changes in weight were chiefly due to changes in the moisture content—entirely so in the case of oats, although slight respiration had taken place with barley and wheat. The amounts lost from this cause, however, were small, averaging less than 1 per cent. for barley and between 1 and 2 per cent. for wheat. Respiration was greatest by a very small amount in the high humidity series.

The increase in the moisture content is greater in passing from 75 per cent. to 90 per cent. than in passing from 60 per cent. to 75 per cent. relative humidity. In the series of 90 per cent. humidity at 68° F., the wheat and barley samples began to lose weight slightly, after increasing steadily for three and a half months. The oats, however, continued slowly to increase in weight. Storage of these samples was continued for four weeks longer, when they appeared to be reaching equilibrium. The losses in the wheat and barley were probably due to the occurrence of some biological reaction, causing counter losses of moisture, and may have indicated the commencement of deterioration of the grain. It should be noted that the oats, which behaved normally, gave no indication of appreciable respiration.

The results of these investigations show that the effect of climatic variations on the weight of stored crops is relatively small, since the greatest change observed over a period of four months was only 5 per cent. On the farm, considerably higher losses often occur in the same time. The difference may be due in part to increased respiration in the stack; the amount of respiration occurring in wheat, for example, increases enormously at 80-90° F.

An Investigation into the Losses that Occur During the Storage of Farm Crops (Mr. W. S. Gibson and Dr. W. Goodwin). —In order to gain information as to the nature and amount of loss which takes place when wheat is left in the stack for varying lengths of time, under ordinary farming conditions, a large stack of Yeoman II wheat at Good Easter, near Chelmsford, was pulled down and built up into six equal small stacks. Care was taken to ensure that as equal an amount of grain as possible was placed in each of the small stacks, and that each should contain the same quantity of produce from the top, centre, base, outside, and inside of the large stack. Two of the stacks were thrashed within a week, on December 23, 1926, two on April 12, 1927, and the remaining two on June 10, 1927. One stack of each of the last two pairs was built on a metal vermin-proof rick stand, the remainder being built on straw laid directly on the ground. When the second two stacks (Nos. 3 and 4) were thrashed, in April, no rats were found in either stack, but mice were found in both. There appeared to be more mice in the stack built on the ground than in that which stood on the metal stand. A certain number of mice were found in both stacks Nos. 5 and 6, though there were fewer in No. 6, which was built on the rick stand. No. 5, which was built on the ground, also contained 8 adult and 16 young rats.

An examination of the weights of thrashed grain from all the stacks showed that there was no significant loss in weight in the case of stacks Nos. 4 and 6, built on the rick stands, despite the intervals during which they remained standing. Stack No. 3, built on the ground and thrashed in April, yielded a smaller quantity of grain than its companion stack No. 4, the difference, 6·53 per cent., apparently being due to damage by vermin. The difference, 9·93 per cent., between stacks Nos. 5 and 6 showed that there was a further loss sustained as a result of vermin damage between April and June.

Moisture content determinations were made from samples from each stack at thrashing. The figure for the original large stack at time of harvest was obtained from comparable data furnished by the National Institute of Agricultural Botany variety trials, and was taken at 17·50 per cent. This figure had fallen to 15·91 per cent. by December 23. The April figures showed another decrease to 13·66 per cent., and finally, in June, the figure was 11·88 per cent. On this basis, stacks Nos. 4 and 6 on the rick stands should have shown

theoretically a loss of weight since harvest from this cause, of about 3·8 per cent. and 5·6 per cent. respectively, but actually did not. The discrepancy was attributable to experimental error, due probably to the fact that it was quite impossible to ensure that an equal amount of grain was put into each of the six small stacks in December. It seems but reasonable, then, to consider that the moisture content figures give the more accurate indication of the loss in weight sustained, apart, of course, from the vermin damage.

In the experiments carried out at Wye, six bags, each containing a known weight of ears, were built into each of three stacks—Bountiful oats, Plumage Archer barley, and Yeoman II wheat, respectively. The mouth of each bag was fastened with a piece of strong rope, one end of which was left about 5 ft. long. The bags were placed well inside, about 10 ft. from the ground, the loose ends of the ropes being left hanging outside the stacks. One of the bags was withdrawn from each stack each month, and various determinations were made upon the grain.

The most striking feature of the results was the small amount of change which took place in the various kinds of grain during the six months' storage in the stack. The bushel weight, the 1,000 grains weight, and the proportion of head to tail corn remained perfectly constant. For the first three months a gradual fall in the 1,000 grains weight was noticed in the case of oats and wheat. This decrease, however, was not maintained, and the weight tended to remain constant for the following three months, except in the last sample of oats, when a marked increase occurred. The 1,000 grains weight in the case of barley was irregular throughout. The bushel weight in all cases remained remarkably constant throughout the period. The variations in the moisture content were so irregular that it was not felt permissible to draw any conclusions. They did not appear to be related to the temperature and relative humidity prevailing at the time the samples were withdrawn.

The results suggest that when grain is stored in the stack under good average conditions the loss of weight is extremely small and probably does not exceed 1 per cent. The large losses which occur in practice are mainly due to damage caused by vermin.

The Effect of Temperature on the Keeping Quality and Bacterial Count of Milk (Capt. H. Barkworth).—Temperature alone of the various weather factors has been shown to

influence the behaviour of milk. Changes in temperature have a negligible effect on the chemical constituents, but considerable chemical changes take place as the result of micro-organic activities. Lactose is changed to lactic acid, resulting in souring, and the lactic acid bacteria, which are chiefly responsible, have an optimum of 68°-71° F., while *B. Coli*, which produces gaseous fermentation as well as souring, has an optimum of 98° F. Up to this optimum, there is an increasing rate of multiplication as the temperature rises, the increase in rate being progressive in itself, so that the difference in rate of multiplication between 65° and 70° F. is many times greater than between 50° and 55° F.

Some indication of the rate of multiplication can be obtained by testing milk samples at different ages and keeping the milk at different temperatures. Capt. Barkworth tested 13 samples at milking time, and when 24 hours old, at a temperature of 70° F. Dr. Savage (Milk and Public Health) gives a table of nine samples, and used temperatures of 60° F. and 70° F. Both tables show that wide variations in multiplication occur at 70° F. The 13 tested samples averaged 2,000-fold in 24 hours at 70° F. for total bacterial count. Dr. Savage found 100-fold. Both tables point to 10,000-fold multiplication of *B. Coli* in 24 hours at 70° F. In addition, Dr. Savage indicates a 20-fold greater multiplication at 70° F. than 60° F. An American worker gives 6,000-fold in 24 hours at 70° F.

A very great increase in both total bacterial count and also in numbers of *B. Coli* is therefore to be expected in hot weather, and is reflected in a dual capacity in lowered keeping qualities of the milk, which is, in general, dependent on the total number of bacteria present, but Dr. Stenhouse Williams has shown that the life is further shortened by the presence of *B. Coli*.

In order to show the effect of temperature on the ultimate behaviour of actual milk supplies, as distinct from laboratory experiments, 186 samples received in connexion with the West Sussex Clean Milk Competition from February to August, 1925, were used. In no case were the samples less than 20 hours old on examination. Having travelled by post, they had been exposed to the general temperature conditions prevailing at the time, and were quite comparable with bulk supplies. The samples were from 31 farms, one sample being taken from each farm at six visitations during the period. The first and second series were taken and kept at

60° F., the third taken and kept at 63° F., the fourth mainly at 63° F., the fifth mainly at 69° F., and the sixth mainly at 66° F. As the temperature rose, there was a steady fall in keeping quality, and also a gradual disappearance of low counts. It was noted that when the temperature, which had risen to 69° F. with the fifth series, fell to 66° F. with the arrival of the sixth series, a recovery was at once shown both in total count and in keeping quality.

Another series of samples was taken in a competition from November, 1925—September, 1926. Twenty-three samples were taken at stated times during the period from each farm, the total number of farms varying from 29 to 31. By considering the results from five selected farms it was shown that when only a really small number of bacteria were present at temperatures of 54°-60° F., no great increase occurred until a temperature of 69° F. was reached, the samples being in all cases 22-28 hours old when examined, and the temperature being that on arrival at the laboratory by post the morning after production. Where larger numbers are present under even low temperature conditions, then high bacterial counts will occur when a temperature of 65° F. is reached.

To show the effect on milk supplies as a whole, three groups of samples were considered, approximately 90 in each group, and received at temperatures of 54°-55° F., 63°-65° F., and 67°-69° F. For the keeping quality test, all samples were adjusted on arrival to 60° F. and thereafter maintained at that temperature. A comparison of these groups shows that, as the temperature rises, it becomes increasingly difficult to conform to a fixed bacterial standard (as with "Certified," Grade "A—T.T.," and other such milks), and the increase in *B. Coli* at 65° F. and also at 69° F. is clearly seen.

The keeping quality tests gave respectively 3¼ days, 2½ days, and 2 days for the three groups considered. Had the samples been kept at their arrival temperatures the first group would have had a considerably longer life, probably 4½ or even 5 days. The second group, if kept at their arrival temperature of 65° F., would have had a shorter life—probably on the average not more than 2 days. The samples at 69° F. would probably not have kept on the average above 1½ days.

It is concluded that any lengthy exposure to a temperature of 65° F. would have a serious effect on both the bacterial count and the keeping quality of milk. Where the initial bacterial count is really low, exposure to this temperature

may be survived without any great effect, but a short period at 70° F. is usually fatal to any milk supply. The rule for milk production has always been to cool as soon and as thoroughly as possible, and to *keep* cool. The nearer we keep to this ideal, the less we shall be at the mercy of climatic variations.

(*To be concluded.*)

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ARTICHOKES AS A FIELD CROP

IN 1925, the Ministry, at the request of the Department of Scientific and Industrial Research, arranged for field trials of artichokes to be carried out at four centres in England. Artichokes were grown to some extent in this country about 30 or 40 years ago, but were not found to be an economical crop. Recent research had, however, shown that the stalk contains a valuable form of cellulose, and it was considered worth while to make an experiment which should demonstrate whether the new use, to which the crop might now be put, would make it economical and remunerative to the farmer to grow it on a field scale. It may be stated, at the outset, that the experiment, carried out in 1925-26, has clearly shown that the cultivation of the crop for the production of cellulose from the stalks is not an economical proposition.

The side of the experiment dealing with the production, harvesting and use, as fodder, of the tubers has, however, brought to light some interesting facts which the Ministry, under authority of the Department of Scientific and Industrial Research, deems it desirable to make public.

Experimental plots of artichokes were grown at the following centres :—

The University Farm, Cambridge.
The University Farm, Shinfield, near Reading.
The Lord Wandsworth Agricultural College, Long Sutton, Hants.
The Kelham Estate, Newark-on-Trent.

From four to six acres were grown at each centre, the total area being about 20 acres. The University, Reading, has already published a record of the Shinfield experiments as its Bulletin XXXV, *Report on the Feeding of Jerusalem Artichokes to Pigs*, by K. W. D. Campbell, M.C., B.Sc.Agric. (Durham). No detailed report of the results at the two last-named centres was prepared. The Cambridge results have not hitherto been

published, and, as the experiments at that centre were the most complete of all those carried out, they will be fully dealt with here. Acknowledgment must be made of the thoroughness with which the work was carried out by Mr. Arthur Amos, the Director of the University Farm, and by Mr. H. R. Davidson, of the School of Agriculture, Cambridge, who assisted him.

The Cambridge Experiments: *Cultivation and Yield of the Crop.*—Four acres were planted in a field, the soil of which varied between light gravel and gravelly loam, where a crop of thousand-headed kale had been grown and folded off with sheep.

Planting took place in May at the rate of about 10 cwt. per acre, and was carried out in the way usually adopted with potatoes. The rows were 30 in. apart, and the sets 15 in. apart in the rows. At the beginning of June, the crop received a dressing of superphosphate at the rate of 3 cwt. per acre.

The development of the plant was affected by the varying degrees of rainfall experienced during the summer months, but it is not possible definitely to assess the extent to which weather conditions affected the yield, even when comparison is made with the conditions prevailing at the other centres.

By October, the height of the stems was in most parts between seven and eight feet, and the ground was so thoroughly shaded by the leaves that annual weed growth was completely suppressed. Light frosts in October and severe frosts in early November, however, cut down the foliage prematurely, and thus limited the yield of both stalks and tubers.

The stalks were cut and roughly stripped of leaves in November and December. This operation absorbed a considerable amount of labour—50 man-days for the four acres. The resulting crop of stalks stripped of leaves and partially dried amounted to six tons. The estimated total crop of tubers was 50 tons.

Disposal of the Tubers.—The problem of how to deal with this quantity of tubers now presented itself to those in charge of the experiment. It was found that the market for the Jerusalem artichoke, as a vegetable for human consumption, was very restricted, and that, moreover, the price received barely repaid the cost of lifting and carriage, while the quantity of tubers available was in excess of what could be consumed by the stock of pigs on the farm.

A considerable quantity was lifted throughout the winter, in spite of the difficulty of digging and picking up the com-

paratively small tubers in the prevailing heavy condition of the land. These were carted to the pig buildings and fed to the whole pig stock; particular care being taken that the rations for the experimental pens of fattening pigs should be fully maintained.

With the advent of spring weather, it was decided to fold the stores and the dry sows on the artichokes. As soon as the weather and soil began to dry in March, rough pig shelters were erected in the field, and a commencement was made with the folding of the crop. One lot of 23 store pigs, averaging 12 weeks in age, were put in one field and some dry sows in another, and were fed with 2 lb. of meal and the maximum quantity of artichokes which they could consume without scouring. It was found that they ate the artichokes greedily, and that the only difficulty was the tendency of the pigs to scour if too many artichokes were fed. The difficulty was overcome by feeding a limited quantity of tubers each day. The store pigs were kept on the artichokes till April 28, when they were brought into the yards to fatten. No record was kept of their gain in weight, but they kept perfectly healthy and throve well on the diet. The sows in like manner kept in good condition.

By a fortunate accident, it was discovered that sheep would eat artichokes. Arrangements were accordingly made for folding the ewe flock (130 head) on the tubers, and, by this means, it was possible to secure the consumption of the whole quantity in time to crop the field in 1926.

It was found that the ewes would readily consume and thrive on as much as 12 lb. of artichokes per head, daily; but that if the ration exceeded that amount they showed a tendency to scour. Lambs were found to scour when they ate the tubers.

It appears, therefore, that one conclusion to which the Cambridge experiment leads is that, for folding both to pigs and to sheep, artichokes are suitable when they have previously been dug out in dry weather and when folded on reasonably dry soil. It appears that in New Zealand a fairly common practice is to allow pigs to root the tubers out for themselves, and it is probable that they could do so in this country if artichokes are grown in very loose sandy soil.

In the Reading experiment, pigs were also found to eat the tubers readily, and 10 lb. of tubers were substituted there, with no apparently disadvantageous effect, for 1 lb. of meal in the ration. At Long Sutton, while the pigs willingly ate the tubers, they showed a tendency to scour.

The exhaustive feeding test, which was carried out at Cambridge with fattening pigs, clearly showed, however, that while artichokes are greedily eaten both boiled and unboiled, their use leads to the production of carcasses definitely inferior to those of pigs fed on boiled potatoes.

For this experiment, four pens of pigs were put up on December 12, 1925. All the pigs were pure-bred Large Whites from the University Farm herd, out of registered sows, and all by the same boar. The average age of Pens 1 and 2 was 146 days; of Pen 3, 137 days; and of Pen 4, 134 days. As the pigs in Pens 1 and 2 were distinctly older than those in Pens 3 and 4, no attempt was made to compare all four pens, but only to determine the difference between the two in each pair.

The rations were arranged so that approximately half of the dry matter was consumed as meal and half as tubers, so that the rations consisted of one part cereal mixture and four parts by weight of tubers. A standard cereal ration was used for all four pens. At the beginning, about 2 per cent. of a mixture, containing salt, chalk, iron oxide and potassium iodide, was added to the ration, but, as there is some difference in the analysis of the minerals in potatoes and artichokes, the pigs were later allowed a free choice of the more important minerals.

The tubers fed to Pens 1 and 2, at the beginning of the experiment, were boiled potatoes and boiled artichokes, and those fed to Pens 3 and 4, raw potatoes and raw artichokes, respectively. The cereal mixture consisted of

Bean meal	2 parts
Tail corn (mostly barley)	1 part
Sharps	1 part

The dry matter in the tubers was estimated during the course of the experiment with the following results:—

Potatoes, 18·07 per cent. Artichokes, 17·63 per cent.

Early in the experiment, it was found that the pigs in Pen 3 were doing so badly on raw potatoes that the ration as stated above was altered, and the potatoes for that pen were boiled before being fed. This Pen and Pen 4, however, did not thrive as well as the other two, and the experiment, so far as they were concerned, was not carried to its conclusion.

The pigs in Pens 1 and 2 were sent for slaughter on February 2, 1926, to the St. Edmundsbury Co-operative Factory. It is not proposed here to give details of the weights and comparative condition of the carcasses. The difference was very clearly marked, and, whereas the carcasses of the pigs fed

on boiled potatoes were found to be better than any previously sent to the factory from the University Farm, the carcasses of those fed on boiled artichokes were reported as being not properly finished and of very poor quality. This evidence appears to be conclusive.

Cost of the Crop.—The cost of growing the crop is high. The average cost for four centres, which incidentally represented varying types of soil conditions, amounted to something over £24 per acre. This would no doubt be reduced if the crop were grown in a subsequent season. But it does not represent the whole cost of handling the crop. The charges for carriage of seed and of the resultant crop are not included, and these in respect of the dried stalks are very high. Nor is any charge made in respect of harvesting the tubers.

Moreover, the tubers are difficult to eradicate from the land, and may so persist as to require a considerable expenditure of labour and of money to remove them in a subsequent season.

Conclusion.—The experiment has, therefore, shown that, although artichoke tubers are readily consumed by both sheep and pigs, they have a tendency to cause scouring ; and that, in the case of fattening pigs, they have a detrimental effect on the bacon produced. The cost of the crop is too high to encourage the development of a market for the stalks for the production of cellulose. The conclusion which must be drawn is, therefore, that there appears to be no prospect at present of making the cultivation of artichokes profitable on a field scale.

The Ministry wishes to express its appreciation of the assistance it received in the investigation from the Authorities and staffs of the four centres where the trial fields of artichokes were cultivated.

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FEBRUARY ON THE FARM

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Seasonal Notes.—The name of this month is derived from that of the Roman Februarius, which in its turn was derived from Februus, one of the names of the god of fertility and the deity who protected the flocks from wolves. The festival in honour of this god was celebrated on the 15th of the month and originally it was a shepherds' anniversary ; later, it became the festival of purification and expiation, having lost its original import when the Romans were no longer a nation of shepherds.

It is noteworthy that in most European countries there are adages which express objections to mild or dry weather in February. We say that when gnats dance in February, the husbandman becomes a beggar. The Germans have a couplet which means lock up your corn in the bin when you see midges on the midden. Tusser, the author of *Five Hundred Points of Husbandry*, published in 1524, wrote "February fill dyke, With what thou dost like," and there are proverbs in several languages which state that full ditches in this month foretell full barns. Another of Teutonic origin favours the occurrence of north winds in this month, adding that if they do not come in February they will certainly be felt in April.

Candlemas, February 2, is a day of some agricultural importance, and in some districts this is the date for leaving and entering farms. Lancashire, Cheshire, and many districts farther south on the same side of the country have Candlemas customs. Tenancies which commence on this date are often complicated by customs of pre-entry and hold-over, whereby the new tenant receives access to the stubbles in autumn while the outgoer retains possession of the house, most of the buildings and certain grass fields until the first of May. These inconvenient customs tend to disappear with the extension of modern valuation practice. Excepting the fact that a removal at this date involves difficulties where milk is sold by contract dating from April 1, there are certain advantages in the Candlemas tenancy which a Lady Day farm lacks. At the earlier date, time is not so precious as it usually is at the end of March, and the earlier entry gives the incomer a better opportunity of arranging the cropping of his arable land according to his wishes and of carrying out the operations of ploughing and manuring necessary for that purpose.

Land and Crops.—As mentioned in last month's notes, weather conditions in the autumn prevented normal progress with the work of cleaning stubbles, wheat sowing, and ploughing. Since the middle of December, the land has been either frost-bound, covered with snow, or sodden with moisture; and to the arrears mentioned as apparent at that time have been added those of the ploughing after roots, potatoes and beet, and the breaking up of leas, as well as the accumulation of manure in yards. A farmer must have extraordinary faith in such old weather lore as is above quoted if he can this year wish for a wet February.

There is no doubt that it will be necessary in many cases to depart from the normal course of cropping in order to overtake the accumulated arrears, and to mitigate the consequences of the preceding bad season. Some parts of the arable land will not give anxiety or require special treatment; the corn stubbles seeded down last year have generally a good take of young "seeds," and, in this case, the usual harrowing and rolling may if necessary be omitted, except where yard manure has been applied or surface stones have to be pressed down. Last year's leas also will receive customary treatment, except where the ploughing has been delayed so late that it may be advisable to apply about 5 cwt. of complete mixture of artificials to compensate for the undecayed condition of the sward. The drilling of this land with oats or barley may generally be carried out fairly early, as it becomes dry and workable before land that has not been recently cropped with "seeds."

In dealing with land that carried roots and potatoes in 1927, such ploughing as may be necessary at this date should be shallow, about four inches being a suitable depth for spring corn in these circumstances. This depth of working not only allows of a wider furrow, and therefore more rapid progress, but it also facilitates the requisite drying of the seed bed for further tillage and sowing, whereas deeper work tends to delay these ends.

Less simple problems will be encountered in deciding and carrying out the treatment of unseeded stubbles. Weather conditions in 1927 encouraged the growth of grassy weeds, and there was no opportunity for stubble cleaning after harvest. Land that bore a first corn crop last season would in the ordinary course of husbandry have been cleaned, manured, and drilled in October or November with wheat or winter oats. Spring oats and barley will be drilled on such fields of this group as were not sown in autumn and winter, except in cases where, owing to the dirty condition of second-corn stubbles, a portion of this area is set aside for sugar beet and mangolds. This departure from strict five-course practice is better than attempting to cultivate the full acreage of second corn in the one case and of roots after second corn in the other, when, owing to special circumstances, the second stubbles are too weedy to be prepared for seasonable sowing with beet and mangolds.

To permit of the above plan, a portion of the land ordinarily due to be cropped with roots will have to be treated

otherwise. The potato crop, being tolerant of spring cleaning and workings, may occupy its usual place; and, if the setts are boxed so that they may be sprouting during March and, if necessary, April, the date of planting may without prejudice to the crop be delayed until cleaning has been thoroughly effected. Swedes and common turnips, and crops of the kale group, may also occupy their customary place. The area set free by the cultivation of beet and mangolds after the first corn crop, however, may be either bare-fallowed or sown with a smother crop that does not require singling and hand-weeding. Marrow-stem kale, if heavily top-dressed, will fulfil these conditions; but, probably, for most cases, the more convenient course is that of sowing a vetch and cereal mixture for hay or for silage, which may be cleared from the land in July and thus allow of summer and autumn cleaning. If this plan is decided upon, an endeavour should be made by liberal top-dressing to produce a weed-smothering crop. Beans may be included in the mixture where ensilage is the intention, and, to give them a fair chance, they should be ploughed in about four inches deep some two or three weeks before the cereals are drilled. For hay-making, peas are regarded as preferable to vetches on account of their better drying properties.

Arable Farming and Live Stock.—Correspondents have asked for further information on the statement made in last month's notes to the effect that the economic weakness of our system of arable farming is not the corn crops but the fodder crops and the live stock by which they are consumed. In ordinary four-course husbandry, there is one acre of fodder roots and one acre of clover or seeds lea to every two acres of corn crops; half of the roots and most of the seeds are fed on the land by sheep, while the other half of the roots is carted to the yards and consumed by bullocks, which at the same time convert straw into manure and incorporate therewith fertilizing residues purchased in the form of concentrated feeding stuffs. When the cost of labour, cakes and meals, and other expenses except coarse fodder, is deducted from the increase in value of the animals fattened, there remains little balance to set against the cost of producing the roots, hay and straw fed. In recent years, this balance has been less than the production costs of these crops; and whether the criticism be directed against these costs, or against the apparently unprofitable returns from the crops, or against the heavy cost of the manure made

from them by bullocks and sheep, the net result has been the same, *i.e.*, a poor profit or a net loss on the arable farming system as a whole.

In the light of the official statistics, it may appear to be an established fact that the remedy for the above state of affairs is to lay the arable land down to grass; that being what most practical farmers seem to consider the best plan. Escaping arable difficulties by grassing down is not a real solution of the main problem, unless there is likelihood of greater profit or less loss from the land when in grass than as arable; and, without a definite object for and method of utilizing the pasture when made, there is no such likelihood. In my opinion many farmers could, with advantage, intensify the treatment of some of their existing grassland and convert a part of the remainder into arable. I am here thinking mainly of dairy farms where too large a proportion of the total returns is expended on bought foods.

There are two directions in which, under suitable conditions, the typical corn-producing system can be strengthened. The first is that of reducing the proportion of fodder crops and increasing that of the cash crops. In the Lothians rotation, only one-third of the arable land is devoted to roots and seeds as compared with one-half in the English four-course and two-fifths in the five-course rotation. The introduction of sugar beet in place of mangolds and turnips needs no further explanation in connexion with arable farming, although it is not invariably sound economy on a dairy farm where heavy crops of fodder roots can be grown. Potatoes may be likened to sugar beet for the purposes of this discussion. Perhaps the above principle may be seen carried out to its utmost possibility on the large German arable farms, where the rotation followed is: potatoes, wheat, beet, barley. No seeds and no fodder roots, nothing in fact is grown specifically for consumption by live stock; but beet tops and pulp and straw are utilized for feeding purposes; and, on one farm which I recently visited, so much of the straw as could not be sold or used as litter (by the stock kept to use up the beet tops and pulp) was being made into artificial dung. Artificial manures were being liberally used, these taking the place of manurial residues of the concentrates fed in the English system; and the result of the system was not only success in the matter of fertility and large crops, but also a net profit on the working.

The second direction of modification is that of substituting cows for bullocks and sheep. This is what many of our arable farmers are doing, and many others have done. This plan depends less on soil considerations than on the possibility of marketing the milk produced. The quantities of food required to produce a gallon of milk and a pound of beef are much the same; and, while the former brings in 1s. 3d. and the latter only about 8d., there is no doubt as to which is the more remunerative. In Denmark and Germany, however, where this plan has been widely adopted, the prices of the gallon of milk and the pound of beef have tended towards the same level; but, in spite of this, the dairy cow is preferred to the fattening bullock.

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NOTES ON MANURES FOR FEBRUARY

H. V. GARNER, M.A., B.Sc.,
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The Need for Potash.—Under the older system of farming, in which grain and fat stock were the chief sales, and all the roots and straw were kept on the holding, the need for potash manures was not severely felt. In fact, the excellent farming of 70 years ago was carried out without any supplies of potash beyond that provided in the farmyard manure, bonfire ashes, and the small quantity occurring in purchased feeding stuffs, most of which contain less than 2 per cent. Turning to the other end of the scale, we may refer to the conditions of intensive culture of market garden crops on light soils. Here, unless great quantities of dung or seaweed are available, the need for potash is most marked, and forms a governing factor in production. The crops themselves remove much potash from the soil and the bulk of the produce is sold off the holding. The high prices, which growers farming such land were prepared to pay for potash during the scarcity arising out of the war, gave an indication of the part played by this fertilizer in their system. Between these two limits comes the ordinary arable farming of the present day, and the lighter the soil, and the greater the acreage devoted to such crops as potatoes, sugar beet, carrots and onions, the more will be the need of potash fertilizers. Even under such conditions on farms, where good dung is abundant, the effect of potash shortage does not readily show itself, but, while the crops will, probably, be fairly good, a potash dressing would improve them. In the absence of a large supply of dung, however, the

effect of potash starvation is obvious, particularly in potatoes, where the leaf takes on a dark bronzed colour, dead patches appear at the margins, and cropping is reduced to a very low level. Until recently, farmers who used mixed fertilizers were usually offered a compound which contained too little potash to correct the conditions mentioned above; this state of affairs has improved of late, and 10 per cent. of potash in a compound manure or home-made mixture is quite little enough in cases of marked need.

Nitrogen and Rainfall.—The past season has been a wet one in many districts. Heavy rain throughout the summer saturated the ground, and, although autumn and winter have not been abnormally wet, nevertheless, owing to the water-logged conditions of the land after harvest, small falls were enough to cause the drains to run. Under these conditions, it could be expected that spring would show a deficiency of nitrates in the soil, as it is on them that by far the most serious loss by leaching falls. Fortunately, we are in a position to remedy this, for spring dressings of quick-acting nitrogenous fertilizers serve to supply what has been lost. Winter corn will need special attention in this matter from the end of February onwards, when judicious top dressings should be well justified.

Urea.—In recent years, the tendency has been towards high-grade fertilizers in order to save charges for bagging, railway carriage, and handling on the farm. No doubt, as the use of artificial manures extends to more distant and inaccessible parts of the world, these considerations will be even more cogent than they are now. The most concentrated form of nitrogen, at present available, is urea, which contains no less than 46 per cent. of nitrogen in the form which occurs in the urine of farm stock, and, as such, is well known, and perforce often neglected by, farmers as a valuable source of plant food. In the course of transformation in the soil, urea reaches the state of nitrate and is then readily taken up by crops. Urea has been produced chemically from the nitrogen of the air for some years in Germany, and will probably soon make its appearance in this country; a few of the experimental results obtained with this substance in recent seasons at Rothamsted, given in the accompanying table, may therefore be of interest.

It will be seen that each form of nitrogen has been equally effective both in the years when the response was good and in the two seasons—1923 in barley and 1921 in potatoes—when

YIELD OF BARLEY PER ACRE.

	1921		1922		1923		1924	
	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.
No nitrogen	26·1	17·6	25·2	16·8	21·2	14·8	23·9	14·1
Sulphate of ammonia	35·0	23·5	32·3	20·3	22·8	17·9	33·8	19·7
Equivalent urea ..	34·0	23·4	33·4	21·8	24·7	16·1	32·8	19·6

	WINTER OATS, 1926.		POTATOES, 1921.
	Grain	Straw	Tons
	Bush. pr. acre	Cwt. pr. acre	Per acre
No nitrogen	61·1	34·1	2·0
Sulphate of ammonia ..	69·0	39·2	2·3
Equivalent urea ..	75·1	43·3	2·3

nitrogen showed little action. Experiments are continuing, but it can be taken that, up to the present the behaviour, of urea has been approximately the same as that of sulphate of ammonia on the Rothamsted soil.

Early Grass.—Stockowners look forward to the day when their pastures will be fit to carry stock in the spring, and relieve the pressure of indoor feeding; and it has long been known that farmyard manure used on pasture has the effect of giving that early start which is so valuable. Two causes are at work here; the shelter from cold winds provided by a dressing of long manure: and, what is probably more important, the manurial effect of the dung. No doubt, this fertilizing action is mainly associated with the nitrogenous constituents, although the potash and phosphate play some part. It is, perhaps, not so widely known that an early top dressing with some form of nitrogenous manure will produce similar effects in hastening the spring flush of grass. There are many possible forms in which this nitrogen may be given, but, at present prices, sulphate of ammonia would serve as well as any, and 1 cwt. per acre would be a normal dressing, to be applied early in the spring just as the herbage is beginning to wake up after the winter period.

Nitrogenous fertilizers can also prolong the growth of grass at the other end of the season, a fact which may be used with advantage by graziers when indoor keep is likely to be short.

It should be stated that the successful use of nitrogen on pastures, as a regular feature of management, requires periodical

dressings of phosphate potash, and, probably, lime, in order to maintain fertility and enable the nitrogen to produce its best effect.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending January 11				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 7	11 7	14 8
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 11*	10 11*	10 11*	10 11*	10 3
Calcium cyanamide (N. 19%) ..	8 16‡	8 16‡	8 16‡	8 16‡	9 3
Kainit (Pot. 14%)..	3 7	2 17	2 19	3 0	4 3
Potash salts (Pot. 30%)	5 2	..	..	4 17	3 3
,, (Pot. 20%)	3 17	3 5	3 9	3 9	3 5
Muriate of potash (Pot. 50-53½%)	9 10	8 15	9 6	9 16	3 8
Sulphate ,, ,, (Pot. 48-51½%)	11 10	10 15	11 10	11 17	4 7
Basic Slag (T.P. 32%)	3 8§	3 3§	3 3§	..	..
,, (T.P. 30%)	3 6§	3 1§	3 1§	2 15e	1 10
,, (T.P. 28%)	..	2 12§	2 13§	..	..
,, (T.P. 26%)	..	2 6§	2 7§	..	..
,, (T.P. 24%)	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10d	0 10
Fine grade‖	2 10	2 10	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 4	3 0	1 9
,, (S.P. 33%) ..	..	..	3 2	..	..
,, (S.P. 30%) ..	2 15	2 12	2 18	2 15	1 10
Bone meal (N. 3¼%, T.P. 45%) ..	8 15	8 10	8 10	8 7	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	5 17†	6 2†	6 5	5 17	..
Burnt Lump Lime	1 9	1 12a	1 16b	2 1§	..
Ground Lime	1 18	2 1a	2 6b	1 15§	..
,, Limestone	..	..	1 10b	..	..
,, Chalk	..	1 9	..	1 5§	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull. *b* Delivered to Liverpool area.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.o.r. Northern rails; 3s. 6d. per ton extra on Southern rails.

NOTES ON FEEDING STUFFS FOR FEBRUARY

H. E. WOODMAN, M.A., Ph.D., D.Sc.,
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The Farmer's Sheet-Anchor.—Under this title, a very interesting and suggestive review of the live stock side of agriculture has appeared, from the pen of Professor T. B. Wood, in *The Nineteenth Century* for August, 1927. The importance of this timely article cannot be overstressed. We are all, farmers and scientific men alike, concerned to find out ways and means for ameliorating the conditions of the great industry in which we are interested. It may truly be stated that Professor Wood's article constitutes a very real effort in this direction. It will not be out of place, therefore, to devote this month's space to a short summary of the article in question, especially in view of the fact that much of what Professor Wood has written bears directly on the problems of intensive production, a question which was touched on in a general manner in the Notes for last month.

Professor Wood quotes official statistics to show that the live stock industry provides by far the greater part, almost 70 per cent., of the farmer's gross takings. In this sense, therefore, live-stock truly constitutes the farmer's sheet-anchor. The economic results of the several branches of the live stock industry, however, vary very greatly. This is a fact of obvious importance, since the farmer does not live on his gross takings (or should not, as Professor Wood dryly interpolates) but on his net takings, that is to say, on the difference between his gross takings and their cost of production. Beef and mutton are almost invariably produced at a loss to the farmer; the production of pork and bacon is speculative; milk production has very generally given a fair profit; in the case of poultry and eggs, the profit has invariably been high. These facts are emphasized if a comparison be made of the value of the output of these various items for the years 1908 and 1925. Calculating value in both cases on the basis of 1925 prices, it is seen that, although the total value of the output of live stock and its products has only risen by 1 per cent. since 1908, the value of the output of meat and wool has declined by 10 per cent. and 27 per cent. respectively, whilst the value of the output of dairy produce and of poultry and eggs has increased by 16 per cent. and 36 per cent. respectively. During the same period, the number of milch cows has increased considerably, the

numbers of poultry enormously, whilst the increase in the numbers of meat-producing animals is comparatively small. The comparison brings out the further fact that the farmer is now selling for slaughter smaller, and therefore presumably younger, animals. Although beef production as a whole has been uneconomic, one aspect of it, namely, what is known as "baby beef" production, is often said to be profitable. The farmer therefore is tending to increase the number of his cows and hens, and to fatten his cattle at an earlier age.

Why, however, should milk, egg and "baby beef" production be more profitable than meat production in general? In the first place, Professor Wood points out, the profitableness of the dairy industry can only partly be explained by the circumstance that the farmer is practically secure of the home milk market. Although *fresh* milk is not imported, vast quantities of other dairy products like cheese, butter and dried milk come from abroad. The order of the events which have placed milk and egg production on a sound economic basis is: Firstly, the invention of an accurate and generally applicable measure of individual production. The data obtained by milk recording for dairy cows and by the use of trap nesting for poultry have given the breeder an exact numerical measure of the productive capacity of individuals. Secondly, this has made possible the breeding of improved productive strains and, along with this improvement, there has been corresponding progress in respect of feeding and management.

The state of affairs in the meat-producing industries is entirely different. It is usual to judge the progress of meat-producing animals by hand and eye, a method which in accuracy can scarcely compare with such methods as weighing milk or counting eggs. The ordinary farmer has no numerical measure of the rate of meat production; he cannot, therefore, accurately assess the results of his feeding and management, and, for that reason, the feeding and management of meat-producing animals lag behind the methods employed for milch cows and poultry.

Professor Wood then outlines a scheme whereby it may become possible to achieve for the pig industry what milk recording has done for the dairy industry. The essential feature of this scheme is the establishment of communication between producer and factory, with the object of securing very full information concerning the influence of varying feeding and management on the quantity and quality of the meat pro-

duced by pigs, and the length of time the animals have taken since birth in reaching factory size. Unfortunately, however, Professor Wood sees no immediate prospect of evolving similar methods to improve the conditions of beef and mutton production until the preliminary step has been taken of establishing co-operative slaughter-houses for sheep and cattle. It will also be essential, in his opinion, to undertake the proper organization on a large scale of the present transference of cattle from the breeding districts of the West Country to the feeding areas of the Midlands and East Anglia. By such detailed and collaborative organization it may become possible to devise accurate measures of the rate of meat production similar to those provided by milk and egg recording in the case of milch cows and poultry respectively.

Professor Wood next reminds his readers that if our animals are to be made more highly productive, they must be better fed. He draws the interesting conclusion that to attain an all-round standard of high productivity, such for instance as that of the 1,000-gallon cow, the 200-egg hen, the pig which is ready for the factory at six months, and the steer which makes "baby beef" at 18 months, the national bill of fare of our live stock must include concentrated foods (in which is included the dry substance of root crops) and coarse fodders in equal proportions. Going into figures, however, he shows that the annual supply of concentrated foods available for farm animals in the British Isles amounts to about 16,000,000 tons, whereas the grand total of coarse fodder is about 48,000,000 tons, that is to say, a ratio of coarse fodder to concentrated food of 3 : 1. An all-round standard of high productivity is therefore not possible under the present conditions. Further, such a state of affairs leads to a scramble for the short supply of concentrated foods, and hence prices rise to uneconomic levels. The position will not be ameliorated as the acreage of arable land declines and as sugar beet replaces other crops.

The central problem of to-day, therefore, is to bring about a material increase in the supply of concentrated foods. How is this problem to be solved? Professor Wood shows how the results of recent pasture research at Cambridge and elsewhere point the way to a simple and satisfactory solution. It is now generally recognized that the digestibility and nutritive value of the dry substance of young grass are such as are associated with good protein concentrates. Moreover, it has been demonstrated that grass, closely grazed, retains its pro-

DESCRIPTION	Price per qr. s. d.	lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	10 7	0 13	9 14	72	2 9	1·47	9·6
Barley, British feeding	—	—	9 5	0 10	8 15	71	2 6	1·34	6·2
„ Canadian No. 3 Western	39 6	400	11 2	0 10	10 12	71	3 0	1·61	6·2
„ American	38 0	„	10 13*	0 10	10 3	71	2 10	1·52	6·2
„ Persian	37 6	„	10 7	0 10	9 17	71	2 9	1·47	6·2
„ Russian	38 6	„	10 15	0 10	10 5	71	2 11	1·56	6·2
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1·70	7·6
„ „ black and grey	—	—	9 15	0 11	9 4	60	3 1	1·65	7·6
„ Irish, white	—	—	10 13	0 11	10 2	60	3 4	1·78	7·6
„ „ black	—	—	9 10	0 11	8 19	60	3 0	1·61	7·6
„ Canadian No. 2 Western	34 9	320	12 3*	0 11	11 12	60	3 10	2·05	7.6
„ Argentine	29 0	„	10 3	0 11	9 12	60	3 2	1·70	7·6
„ Russian	29 3	„	10 5§	0 11	9 14	60	3 3	1·74	7·6
Maize, Argentine	38 9	480	9 0	0 11	8 9	81	2 1	1·12	6·8
Beans, English, winter	—	—	9 0†	1 6	7 14	66	2 4	1·25	20
Peas, English, blue	—	—	15 5†	1 3	14 2	69	4 1	2·19	18
„ Japanese	—	—	24 15§	1 3	23 12	69	6 10	3·67	18
Dari, Palestine	—	—	11 5	0 13	10 12	74	2 10	1·52	7·2
„ Persian	—	—	11 0	0 13	10 7	74	2 6	1·34	7·2
Millers' offals—									
Bran, British	—	—	8 10	1 3	7 7	42	3 6	1·87	10
„ broad	—	—	9 5	1 3	8 2	42	3 10	2·05	10
Middlings, fine, imported	—	—	10 7	0 18	9 9	69	2 9	1·47	12
„ coarse, British	—	—	8 17	0 18	7 19	58	2 9	1·47	11
Pollards, imported	—	—	8 0	1 3	6 17	60	2 3	1·20	11
Meal, barley	—	—	11 17	0 10	11 7	71	3 2	1·70	6·2
„ maize	—	—	9 15	0 11	9 4	81	2 3	1·20	6·8
„ „ S. African	—	—	9 7	0 11	8 16	81	2 2	1·16	6·8
„ „ germ	—	—	9 10	0 16	8 14	85	2 1	1·12	10
„ „ gluten feed	—	—	9 15	1 1	8 14	76	2	1·20	19
„ locust bean	—	—	8 17	0 8	8 9	71	2	1·29	3·6
„ bean	—	—	12 15	1 6	11 9	66	3	1·87	20
„ fish	—	—	21 0	3 10	17 10	53	6 7	3·52	48
Maize, cooked flaked	—	—	11 0	0 11	10 9	85	2 6	1·34	8·6
Linseed—									
„ cake, English 12% oil	—	—	12 12	1 11	11 1	74	3 0	1·61	25
„ „ „ 10% „	—	—	12 5	1 11	10 14	74	2 11	1·56	25
„ „ „ 9% „	—	—	11 17	1 11	10 6	74	2 9	1·47	25
Soya bean „ „ 6% „	—	—	11 10	2 4	9 6	69	2 8	1·43	36
Cottonseed cake „ 5½% „	—	—	8 5	1 10	6 15	42	3 3	1·74	17
„ „ Egyptian, 5½% „	—	—	7 15	1 10	6 5	42	3 0	1·61	17
Decorticated cottonseed meal, 7% oil	—	—	12 0§	2 5	9 15	74	2 8	1·43	35
Coconut cake, 6% oil	—	—	10 0	1 6	8 14	79	2 2	1·16	16
Ground-nut cake, 7% oil	—	—	10 7*	1 7	9 0	57	3 2	1·70	27
Decorticated ground-nut cake, 7% oil	—	—	12 15*	2 5	10 10	73	2 11	1·56	41
Palm kernel cake, 6% oil	—	—	9 10†	0 19	8 11	75	2 3	1·20	17
„ „ „ meal, 6% oil	—	—	10 0†	0 19	9 1	75	2 5	1·29	17
„ „ meal 2% „	—	—	9 0†	1 0	8 0	71	2 3	1·20	17
Feeding treacle	—	—	6 10	0 9	6 1	51	2 4	1·25	2·7
Brewers' grains, Dried ale	—	—	8 7	1 0	7 7	49	3 0	1·61	13
„ „ „ porter	—	—	7 17	1 0	6 17	49	2 10	1·52	13
Malt culms	—	—	6 10*	1 9	5 1	43	2 4	1·25	16

* At Bristol. § At Liverpool. † At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P_2O_5, 8s. 10d.; K_2O, 3s 3d.

ductive character throughout the season. It follows, therefore, that the 34,000,000 acres of grassland in the British Isles are for the most part capable of growing fodder which is essentially productive. The conclusion is finally reached that the only economic method of increasing the ratio of concentrated foods to coarse fodders is by the better utilization, in the direction of closer grazing, of our continually expanding area of grassland. Professor Wood concludes his survey in the following words: "Much new and valuable information has been added to our knowledge of pastures. It is to be hoped that the great national agricultural organizations will step in and ensure that this new information is rapidly absorbed into improved practice."

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	10 14
Maize	81	6·8	9 0
Decorticated ground nut cake	73	41·0	12 15
„ cotton cake	71	34·0	11 5

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·57 shillings, and per unit protein equivalent, 1·72 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1927, issue of the Ministry's JOURNAL.)

FARM VALUES.

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	10 2
Oats	60	7·6	8 7
Barley	71	6·2	9 13
Potatoes	18	0·6	2 7
Swedes	7	0·7	0 19
Mangolds	7	0·4	0 19
Beans	66	20·0	10 4
Good meadow hay	31	4·6	4 8
Good oat straw	17	0·9	2 5
Good clover hay	32	7·0	4 14
Vetch and oat silage	13	1·6	1 16
Barley straw	19	0·7	2 10
Wheat straw	11	0·1	1 8
Bean straw	19	1·7	2 12

MISCELLANEOUS NOTES

The Young Farmers' Clubs Movement

A RECENT census of Young Farmers' Clubs in England (there are none in Wales) reveals that on November 1 last there were 85 clubs actually in operation, with a total active membership of 1,697 and an honorary or associate membership of 536. Of the 85 clubs, 37 are "mixed," that is, they deal with mixed stock such as poultry and rabbits, calves and pigs, bees and so forth, or even with all these ; 31 are poultry clubs, and confine their activities to egg production and the rearing of table birds ; 12 are calf or baby beef clubs ; while there are two rabbit and two bee clubs, and one horticulture club. The number of boy members is 1,055, and of girls 642. Of the boys, 739 are under 14 years of age, 213 are 14 to 16 years old, and 103 are 16 to 20. Of the girls, 458 are in the junior group, 133 in the intermediate, and 51 are from 16 to 20 years old.

The annual dairy cattle-judging contest for members of Young Farmers' Clubs, which was to have taken place at the Dairy Show in October, had to be postponed on account of foot-and-mouth disease, but arrangements were subsequently made, by courtesy of the Northants Education Committee, so that the competition was held at the County Farm Institute, Moulton, near Northampton, on January 26, 1928. A silver challenge cup, presented by *The Farmer and Stock-Breeder and Agricultural Gazette*, won last time by the Sussex Baby Beef Club, and silver and bronze medals, awarded by the British Dairy Farmers' Association, were the prizes competed for.

The third annual conference of leaders of Young Farmers' Clubs was held on January 27, 1928, and a representative gathering discussed the problems which confront the movement, and the best means of development.

In Cumberland, Lancashire, Northumberland, Derbyshire and Leicestershire, there are altogether 13 clubs. Of these, four are in Cumberland and five in Northumberland, and in these counties the movement appears to offer considerable scope for development, as it has behind it the strong support of the respective agricultural education authorities. The Cumberland clubs deal exclusively with poultry, and it is interesting to note that the minutes of one of the meetings of the Boltons Poultry Club were recently presented at a meeting of the Agricultural Education Sub-Committee of the Cumberland Education Authority, and were commended for their interest and lucidity.

Poisonous Plants on the Farm

CLOSELY connected with the question of losses of live stock on the farm is the extent to which plants of a poisonous character are present. Although the number of wild plants which are seriously poisonous is, perhaps, small compared with the total species included in the British flora, yet there are many which occur quite commonly, and which may occasionally cause serious losses of farm stock, while they may also cause illness and death to human beings, particularly children. In cases where poisonous plants occur in quantity, they may be unavoidably harvested with hay or other crops and thus later be given to stock; or they may be eaten in the green state in the open fields and along hedgerows. There are also a number of cultivated plants and trees which are poisonous and are often responsible for trouble with live stock on which they have an irritant or poisonous effect. The question as to the extent to which plants are poisonous on the farm was regarded as so important that the Ministry commissioned one of its officers, Mr. H. C. Long, to prepare the little volume* under this title. It is confidently anticipated that the book will be widely welcomed by farmers—for the reason that it is written simply, is well illustrated, and fills a definite need.

* * * * * *

Notice to Poultry Keepers

THE Ministry has made arrangements for post mortem examinations of poultry, agglutination tests for Bacillary White Diarrhœa, and other bacteriological work in connexion with poultry to be carried out at its Veterinary Laboratory. It is open to any poultry farmer, whose birds are dying mysteriously, or who has other evidence of disease in his flock, to avail himself of these facilities to obtain expert diagnosis of the disease and certain other services from the Laboratory. In all cases where heavy mortality occurs suddenly, or where birds die from some obscure cause, it is desirable that specimens, showing typical symptoms of the disease, should be sent for examination and report.

In order to prevent the introduction of disease amongst healthy stock, newly purchased birds should be isolated for one month and frequently examined during this period. A memorandum showing the terms and conditions under which

* Miscellaneous Publication No. 57. Prices: cartridge covers 2s., quarter bound 2s. 6d., cloth boards 3s., post free if ordered direct from the Ministry.

these examinations are made will be sent on application to either the Ministry at 10, Whitehall Place, London, S.W. 1, or to the Ministry's Veterinary Laboratory, New Haw, Weybridge, Surrey.

* * * * * *

Stamford and District Co-operative Egg and Poultry Society, Limited

THE annual report of this society for the twelve months ending September 6, 1927, marks a further stage in its successful progress, and serves to illustrate the possibilities of co-operative effort on a relatively small scale. The number of eggs handled during the period was 1,787,648—an increase of 81,527 over the previous year, and a record for the society. The efficiency of the society's organization is indicated by the marketing costs, roughly 1¾d. per dozen eggs; these cover transport, wages, etc., and show a saving of ⅓d. over last year's costs, mainly effected on transport, as indicated in the following statement:—

Charges in Pence per Dozen Eggs

	1920-1	1921-2	1922-3	1923-4	1924-5	1925-6	1926-7
Transport ..	1·67	1·54	1·16	0·925	0·86	0·92	0·497
Wages ..	1·25	1·26	1·04	0·958	0·92	0·96	0·929
Other charges	0·55	0·52	0·42	0·318	0·31	0·27	0·301
Total ..	3·47	3·32	2·62	2·201	2·09	2·15	1·727

The society is favourably placed for road transport, and has taken full advantage of the situation; the distribution, as well as collection, of produce is effectively carried out by means of two motor vans at the low figure of approximately ½d. per dozen eggs for transport; it will be seen that cost of transport has shown a steady decrease over a period of seven years. Wages amount to less than 1d. per dozen, and include the cost of "candling" and grading supplies. The necessity for "candling" is demonstrated by the fact that 3,057 bad eggs were received during the year; although the position in this respect has improved, the Committee has thought it well to emphasize in their report the evils of "holding up," and of offering dirty, stale, and bad eggs for sale.

With a margin of 2¾d. per dozen between the average buying and selling prices, the payment of a bonus to members of 6d. in the £ was possible during the past year, in addition to a bonus to the staff; a sum of £87 was placed to reserve and a balance of £100 carried forward.

THE prices of agricultural produce during December were on the whole slightly higher than in the preceding month, and the general index figure shows a rise of one point to 38 per cent. above the level of the base years 1911-13. A year ago the index figure stood at 46 per cent. above pre-war.

The Agricultural Index Number

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	42
September	59	52	61	55	55	43
October	61	50	66	53	48	40
November	63	51	66	54	48	37
December	61	55	65	54	46	38

Grain.—Wheat averaged 9s. 10d. per cwt. as against 10s. 1d. per cwt. in November, but as the fall was almost proportionate to that which occurred in December, 1911-13, the index figure was unaltered on the month at 34 per cent. above the base years. There was an appreciable decline in the price of barley, however, the average being 1s. 2d. lower at 11s. 2d. per cwt., and the index number declined 10 points to 35 per cent. above pre-war. Oats were 1d. per cwt. dearer at 9s. 2d. per cwt., and the index figure advanced by one point to 31 per cent. above the pre-war level. As compared with December, 1926, wheat was cheaper, barley was about the same price, but oats were dearer.

Live Stock.—The average price of fat cattle was raised slightly in December, owing to the holding of the Christmas sales, and second quality cattle at about 41s. 6d. per live cwt. were 16 per cent. dearer than pre-war. Fat cattle were, however, cheaper than in the corresponding period of 1926, when they averaged 46s. per live cwt. and 28 per cent. above the base years. Fat sheep continued to meet a good demand during December, and a rise of 1d. per lb. estimated dressed carcass weight to 11½d. per lb. caused the index number to advance by four points to 44 per cent. above pre-war, which is the same as the figure recorded in December last. This class of live stock

has maintained a fairly constant level during the past six months, whereas other classes, with the exception of dairy cows, have shown an appreciable fall in values. Fat pigs were a little dearer than in November, second quality bacon pigs being 2d. and porkers 3d. more, at averages of 8s. 5d. and 10s. 2d. per 14 lb. estimated dressed carcass weight, and in each case the index figure was higher: the former class of pig advanced by two points to 20 per cent. dearer than pre-war, and the latter by 4 points to 33 per cent., but both classes were very much cheaper than in December, 1926, when baconers made 63 per cent. and porkers 72 per cent. more than in 1911-13. Store cattle made similar prices to those ruling in November, and dairy cows and store sheep were slightly dearer, but as these price movements were in the same direction as, and proportionate to, those in the corresponding period of the base years, the relative index numbers were unaltered on the month at 28 per cent. above pre-war for dairy cows and 35 per cent. for store sheep. Store pigs continued to decline in price, and the index number was three points lower at 41 per cent. above the level of 1911-13.

Dairy and Poultry Produce.—The increase in butter prices customary at this season of the year was continued, and the index figure remained unaltered on the month at 47 per cent. above pre-war, while the index number of cheese also showed no change. Both commodities were, however, dearer than a year ago, when the former was 40 per cent. and the latter 28 per cent. above the 1911-13 level. Milk at 66 per cent. dearer than pre-war was about the same as in December, 1926. Egg prices fell by about 2¾d. per dozen during the month under review, and at an average of 2s. 4½d. per dozen were 41 per cent. dearer than pre-war, as against 47 per cent. in November, and 46 per cent. a year ago. Poultry prices did not rise in December to the extent customary in pre-war years, and the index number for this class of stock fell by nine points to 37 per cent. above the level of the base years 1911-13. At the corresponding period of 1926 poultry realized 49 per cent. more than in 1911-13.

Other Commodities.—There was practically no alteration in potato prices during December, but as there was a slight advance in the corresponding period of the base years the index figure shows a fall of one point to 75 per cent. above pre-war. A year ago potatoes were 110 per cent. dearer than in 1911-13. Prices of hay were fairly steady at 20 per cent. above pre-war, and apples were cheaper on the month and vegetables dearer at 20 per cent. and 66 per cent. respectively above the

pre-war levels. Wool continued to show a slight rise in value, the index number for December being 50 per cent. above 1911-13. as compared with 46 per cent. in November and 43 per cent. in September and October.

Index numbers of different commodities during recent months and in December, 1925 and 1926, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1925	1926	1927				
	Dec.	Dec.	Aug.	Sept.	Oct.	Nov.	Dec.
Wheat	67	61	56	48	42	34	34
Barley	29	31	64	62	62	45	35
Oats	32	17	43	35	33	30	31
Fat cattle	44	28	34	30	23	19	16
Fat sheep	47	44	45	45	41	40	44
Bacon pigs ..	86	63	36	34	22	18	20
Pork pigs	84	72	43	41	35	29	33
Dairy cows ..	—*	30	25	28	27	28	28
Store cattle ..	—*	21	26	24	19	13	13
Store sheep ..	—*	41	48	49	40	35	35
Store pigs	—*	115	70	64	56	44	41
Eggs	74	46	44	54	66	47	41
Poultry	60	49	43	37	43	46	37
Milk	74	65	55	65	57	59	66
Butter	68	40	38	41	41	47	47
Cheese	74	28	57	59	56	55	55
Potatoes	64	110	30	46	72	76	75
Hay	4	2	16	18	18	19	20
Wool	49	29	42	43	43	46	50

* Very few markets for store stock were held during December, 1925, on account of Foot-and-Mouth Disease restrictions.

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International Exhibition of Agriculture, Turin, 1928

THE fourth centenary of the birth of Emanuele Filiberto, Duke of Savoy, and the tenth anniversary of victory in the Great War, are to be celebrated at Turin this year by an International Exhibition of Agriculture, which will be held from April to October. The Exhibition, under the ægis of H.R.H. the Duke of Savoy, who is President of the Executive Committee, has the patronage of H.M. the King of Italy. It will include sections devoted to agriculture ; horticulture ; fruit-growing ; flower culture ; culture of truffles, fungi, medicinal and aromatic plants ; forestry ; parks ; alpine plants ; bee-keeping ; agricultural machinery ; hunting and fishing ; chemical machinery, apparatus and instruments ; silk weaving,

dyeing and printing, with silk machines in operation. The participation of British producers and exhibitors is desired by the Italian Government; and particulars of the Exhibition can be obtained by those interested from Il Commissario Generale, Exposizione di Agricoltura, Via Carlo Alberto, 24, Torino, Italy.

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Short Course for Milk Recorders

A SPECIAL Course in Milk Recording will be held at the University, Reading, from February 21 to March 10, 1928. The chief objects of the Course are (1) to train suitable persons for the duties of a milk recorder, and (2) to extend the knowledge of persons engaged, or interested, in milk recording. Each day's instruction will embrace :—

(*a*) At least two hours' theoretical teaching;

(*b*) Practical work in weighing, sampling, testing, and the keeping of milk records.

Applicants must be able to milk before admission to the Course, and should possess an aptitude for neat penmanship and accurate arithmetic.

At the conclusion of the Course, the authorities of the University, Reading, will notify in writing those students who have satisfied their instructors as to their industry and general ability and who have passed both the theoretical and practical examinations held during the closing days.

SYLLABUS

(*a*) *Lecture Course*

(1) *Milk.*—Nature and composition; causes of variation; Food and Drugs Act; regulations concerning milk.

Bacteria.—Milk as a medium for bacteria; control of bacterial growth, importance of cleanliness; use of preservatives; the Milk and Dairies Act.

Testing.—Weighing, methods of sampling; simple and composite samples; determination of the percentage of fat; and of the specific gravity; the Gerber test; the lactometer, calculation and percentage of total solids from percentage of fat and specific gravity; calculation of averages.

(2) The principles and practice of milk recording; the Ministry of Agriculture Scheme; why accuracy in detail is essential; discussion of the duties of recorders, with a study of the forms which must be kept; milk record certificates and register of dairy cows; interpretation of milk records; calculation of herd averages; breed societies, records and registers of merit; marking of cows; calf and bull marking scheme; methods of keeping food records; the use of the slide rule and calculating machines.

(*b*) *Practical Work*

Actual milk recording; the taking of simple and composite samples under various conditions; determination of the percentage

of fat (Gerber method) and the specific gravity; calculation of total solids; use of the Richmond scale; visits to farms, evening and morning, to weigh milk and make the necessary entries; checking of records; detection of errors and abnormal results; keeping of food records, and calculation of cost of feeding and cost of food per gallon of milk.

The tuition fee for the Course will be £3.

Board and residence are obtainable in the neighbourhood of the University, at rates varying from £1 15s. to £2 5s. per week, and addresses where such lodgings may be obtained will be sent on the applicant's request.

Applications for admission to the Course should be made not later than Saturday, February 11, 1928, to the Dean, Faculty of Agriculture and Horticulture, the University, Reading.

Students are advised to bring cycles with them if possible, as some of the work will necessitate frequent visits to the University Farm.

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Destructive Insects and Pests Act, 1927

THIS Act, which received the Royal Assent on December 22, 1927, amends the earlier Acts of 1877 and 1907. The Act of 1877, which was passed at a time when the Colorado Beetle was sweeping across the North American continent, enabled the Privy Council to make Orders for the prevention of the introduction of the Beetle, and its spread in Great Britain. It empowered the Privy Council to require Local Authorities to carry out any Orders issued by the Council, and to pay compensation for any crops destroyed under those Orders. The Act of 1907 extended the 1877 Act to include other insect and fungus pests.

The 1927 Act enables the Ministry's officers to take the urgent action which would be necessary if a new and dangerous pest were discovered, and extends the definition of "insect" in the original Act so as to include "bacteria and other vegetable or animal organisms and any agent causative of a transmissible crop disease." This provision will enable the Ministry to take action against "Virus" diseases, such as Mosaic and Leaf Roll of potatoes, and diseases of bacterial origin. Power is given for the removal or destruction of any crop infected with a destructive insect introduced into Great Britain, and to take such steps as may be necessary to prevent the spread of the pest. Compensation may be paid by the Ministry for any crops which may be so removed or destroyed, but the amount of compensation and expenses so paid may

not exceed £2,000 in any one year without the consent of the Treasury.

The Act also enables the Ministry to charge fees for certificates given after the inspection of crops (the expression "crop" includes seeds, plants or any parts thereof).

Following the precedent established by the Seeds (Amendment) Act of 1925, the time within which proceedings may be instituted for an offence in connexion with the movement, sale and consignment or planting of potatoes is extended to twelve months from the day on which the offence was committed.

Under the previous Acts, the maximum penalty which could be imposed for offences against any Order was £10, and experience has shown that this penalty has not always been sufficient to prove a deterrent. Provision has, accordingly, been made in the new Act to increase to £50 the maximum penalty for a second or subsequent offence against an Order.

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National Diploma Examinations, 1928

THE regulations and syllabus for this year's National Diploma Examinations in Agriculture and in Diarying, to be held under the auspices of the National Agricultural Examinations Board, are now available, and copies may be obtained from the Secretary, Royal Agricultural Society of England, 16, Bedford Square, London, W.C.1, or from the Secretary, Highland and Agricultural Society of Scotland, 3, George IV Bridge, Edinburgh.

The Examination for the National Diploma in Agriculture will be held at Leeds University on April 11 and following days, and applications to sit for it must be sent in not later than Monday, February 20, 1928. The Examination for the National Diploma in Dairying will be held at Reading University in September next. Full particulars about the National Diploma Examinations can be obtained from the societies named above.

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Grassland Conference at Aberystwyth

A GRASSLAND Conference, which all interested persons are cordially invited to attend, will be held at Agricultural Buildings, Alexandra Road (nearly opposite the G.W.R. Station), Aberystwyth, on Thursday, February 23, 1928, commencing at 10.45, for 11 a.m. The Conference, which will be presided over by Mr. C. Bryner Jones, C.B.E., M.Sc., the Welsh Secretary of the

Ministry, is being held under the auspices of the Agricultural Department, University College of Wales, and of the Welsh Plant Breeding Station. It is hoped that farmers will attend in good number to contribute their opinions and experience to the discussions which will follow the papers to be read (at the morning session) by Professor R. G. Stapledon and Mr. T. W. Fagan, and (at the afternoon session) by Messrs. R. Lindsay Robb, S. M. Bligh, Martin G. Jones and William Davies. A general discussion will follow at 6 p.m. For the benefit of visitors to the Conference who find it necessary to arrive at Aberystwyth on the previous day (Wednesday, February 22), Professor Stapledon has arranged to give a lantern lecture at Agricultural Buildings at 8.30 on that evening dealing with "Grassland and other Lessons," derived during his recent tour in Australia and New Zealand. There will, also, be opportunities for visitors, arriving on Wednesday, to inspect the Grassland Experiments at the Welsh Plant Breeding Station. The full programme and other particulars of the Conference can be obtained on application to Professor R. G. Stapledon, M.A., at Agricultural Buildings, Alexandra Road, Aberystwyth.

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Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on December 19 at 7 Whitehall Place, S.W., Mr. W. B. Yates, C.B.E., presiding. The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions:—

Derbyshire.—An Order continuing from December 26, 1927, until December 25, 1928, the minimum and overtime rates of wages at present in force for male and female workers. The minimum rate in the case of male workers of 21 years of age and over is 8d. per hour, with overtime at 10d. per hour for Sunday work. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 8d. per hour for Sunday work.

Norfolk.—(*a*) An Order continuing from January 1, 1928, until December 31, 1928, the operation of the existing minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter with, in the case of teamsmen, cowmen, shepherds or yardmen, an addition of 5s. 6d. per week, and in the case of sheep tenders and bullock tenders 4s. 6d. per week in respect of employment in connexion with the immediate care of animals. The overtime rates in the case of all male workers of 21 years of age and over are 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

(*b*) An Order fixing special minimum and overtime rates of wages for male workers employed on the corn harvest in 1928. In the case of workers of 21 years of age and over employed throughout the harvest the wage payable in respect of the harvest is an inclusive sum of £11. In the case of workers who are not employed for the full harvest period special differential rates have been fixed for overtime employment on the corn harvest, the rate in the case of workers of 21 years of age and over being 9½d. per hour.

North Riding of Yorkshire.—An Order to come into operation on December 26, 1927, and to continue in force until October 1, 1928, making certain variations in the minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers (other than casual workers) of 21 years of age and over remains unchanged at 33s. per week of 48 hours in winter and 52½ hours in summer, overtime being payable at 10d. per hour on weekdays and 1s. per hour on Sundays. Special hourly rates are fixed for certain employment on work in connexion with the care of animals. Reductions have been made in the minimum rates for male workers under 21 years. In the case of female workers of 18 years of age and over the minimum rate remains unchanged at 6d. per hour for a week of 44 hours, with overtime at 9d. per hour.

Pembrokeshire and Cardiganshire.—An Order to come into operation on January 1 and to continue in force until September 30, 1928, varying the minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 52 hours in winter (instead of 50 hours as at present) and 54 hours in summer, with overtime at 8½d. per hour (instead of 8½d. per hour on weekdays and 9½d. per hour for the first three hours on Sundays and 11d. per hour for subsequent hours as at present). In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a day of 8 hours, with overtime at 6d. per hour on weekdays and 6½d. per hour for the first three hours on Sundays and 7½d. for subsequent hours.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending January 15 legal proceedings were instituted against six employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Hunts ..	Huntingdon	1	0	0	2	2	0	2	18	6	2
Dorset ..	Blandford ..	1	0	0	—			60	12	6	2
Yorks, W.R.	Rotherham.	12	0	0	4	0	0	138	0	0	6
Somerset ..	Bath ..	—			0	14	0	15	8	7	1
Flint ..	Overton-on-Dee ..	1	1	0	0	12	0	7	0	0	1
Cumberland	Wigton ..	—			2	15	0	8	0	4	2
		£15	1	0	£10	3	0	£231	19	11	14

Foot-and-Mouth Disease.—Since the report in the last month's issue of the JOURNAL, 95 outbreaks of foot-and-mouth disease have been confirmed in Great Britain. These outbreaks were in the following counties: Derby, 39; Staffordshire, 15; Lincoln (Lindsey), 11; Yorks (West Riding), 7; Nottingham, 6; Lancashire, 6; Warwickshire, 5; Leicester, 8; Glamorgan, 2; and one in each of the following counties: Northants, Worcester, Lincoln (Kesteven), Huntingdon.

The number of outbreaks confirmed since January 1 last is 44, involving 10 counties and the slaughter of 1,373 cattle, 1,107 sheep, 635 pigs and 4 goats.

During the year 1927, 141 outbreaks were confirmed, as compared with 204 in 1926 and 260 in 1925.

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NOTICES OF BOOKS

Primer of Agricultural Economics. By Sir Henry Rew, K.C.B. Pp. 229. (London: John Murray. 1927. Price, 5s. net.)

The author of this volume approaches most of the subjects dealt with from the historical, rather than from the economic, standpoint; and while the book in the main gives an excellent and succinct summary of historical developments, it does not attempt any exact economic analysis of the factors upon which the production and distribution of agricultural commodities are based.

It is divided into three parts, dealing with the "Factors of Production," the "Costs of Production," and the "Disposal of Produce," respectively, and the chapters relating to the land, farm equipment and management, labour, farm accounts, methods of disposal of produce, markets and prices, form a useful introduction to these subjects. The chapter on "Prices" gives, for the most part, an excellent summary of the principal factors which determine agricultural prices.

The book has the merit of being very readable; it is expressed in simple, non-technical language, and, to a student unacquainted with the subject, will provide a valuable starting point for further study. This is its primary object. It contains a list of books and publications and a useful index.

Farm Soils: Their Management and Fertilization.—By Edmund L. Worthen, M.S. (The Wiley Farm Series.) Pp. x + 410. (London: Chapman and Hall, Ltd., 1927, 13s. 6d. net.)

"Farming soils" might almost have been the title of this book, for it is less a study of the soil than a guide to American agriculture. Although the elementary nature of the opening chapters indicates that the work was planned as a text-book for beginners in farm classes, it could scarcely be used in that way in England, except to demonstrate principles common to all farming, and their application to crops and soil problems (including those of sub-tropical and semi-arid regions) unknown in Britain. As a supplement to the ordinary texts, it might play the part, to some extent, of a tour of the United States.

While the book suffers from the over-simplification, re-iteration, and too-positive theorising common to elementary manuals of instruction, its production is excellent; printing and binding are good and misprints reasonably few. Almost half the pages are decorated with photographs, many of which are interesting. Others, "used only when direct quotations from the text apply to them," seem scarcely necessary.

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THE JOURNAL
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MARCH, 1928.

NOTES FOR THE MONTH

Proposed Scheme of Egg Marketing Reform

WHEN the Standing Committee set up under the Merchandise Marks Act, 1926, considered the question of requiring the marking of imported eggs, so as to distinguish them from British eggs, they recommended that no Order should be made until a sufficient improvement had taken place in collecting, grading, packing, and marketing British eggs, to remove, or at least to mitigate, the danger of the "best" imported egg getting a better market in this country than the average home-produced egg. The Minister, on receiving this recommendation, referred the whole question to his Poultry Advisory Committee, which had recently been reconstituted and is now fully representative of all sections of the industry, including transportation and refrigeration. The reconstituted Committee met for the first time on December 9 last, and appointed a sub-committee to prepare a marketing scheme. This sub-committee submitted tentative recommendations to the main Committee on January 17; these proposals, after some discussion, were provisionally adopted and referred to the National Farmers' Union, the National Poultry Council, and other national bodies concerned. At the time of going to press, the scheme has been considered by the National Poultry Council, the Parliamentary Committee of the Federation of Grocers' Associations, the Council of the National Federation of Retail Fruiterers, Florists and Fishmongers, the Central Committee of the National Federation of Dairymen's Associations, the West of England Egg and Poultry Merchants' Association, and by the Directors of the Co-operative Wholesale Society. The general reaction to the scheme is in the main favourable; so also is much of the criticism that has been received from individuals.

The scheme is primarily designed to assist the industry to recover lost ground on the wholesale market. It is voluntary

in character; those who consider that they can do better for themselves by remaining outside will, of course, do so. At present, English eggs are sold, as a rule, in comparatively small consignments and parcels through regular channels to customers who know their value. If the home egg industry is to develop as it should, it must look increasingly to the wholesale markets for an outlet for its supplies. Foreign eggs reach the wholesale markets properly graded and packed, and large retail sellers of eggs in this country, the big multiple stores and so on, have experience of them according to their brands and, as a result, often take them in preference to English fresh eggs. To be able to compete with the foreign egg in these markets, the home-produced egg must be similarly graded and packed, and must be regularly available in adequate quantities.

The proposals of the Poultry Advisory Committee are of considerable importance in this connexion. It is suggested that the Minister of Agriculture and Fisheries should promote legislation empowering him to make regulations (*a*) defining egg grades, and making it a breach of warranty and a punishable offence for any seller of eggs to apply the grade description to eggs which failed to conform; (*b*) requiring (if and when a Marking Order for imported eggs has been made) the marking of cold-stored and gas-processed eggs; and (*c*) requiring the marking of all "preserved" eggs. At a meeting of the Council of Agriculture on January 26, in a statement on the Government's intention to assist agricultural marketing proposals, the Minister made it clear that the Government were willing to provide time for the necessary legislation during the present Session. It is further suggested that the Minister should register a national quality mark, primarily for use on packages, and appoint a National Mark Committee to control the use of the mark.

As regards action to be taken by the industry itself, it is proposed that the county branches of the National Farmers' Union, in conjunction with local poultry societies and any other local interests, should prepare a roll of "accredited country packers." To these "packers" the National Mark Committee would grant the right to use the national mark so long as they observed the undertakings given on accrediting. These undertakings would include requirements in respect of the candling, grading, and packing of eggs. As the number of "packers" in each county increased, it would facilitate administration if they formed themselves into an area

association with which the National Mark Committee could deal direct. It is proposed that these area associations should ultimately form a central federation, which would include "accredited town packers" enrolled directly by the National Mark Committee. At this stage the National Mark Committee would delegate to the central federation the control of the use of the mark as regards eggs; the industry would thus become entirely responsible for its own organization.

When the scheme is finally thrashed out and passed, it will be for the industry to make it the success which it deserves to be, and for the public to help the industry by buying home produce.

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Work of the Land Division of the Ministry, 1926

A REPORT,* which was published in January, is the first of an annual series dealing with the whole of the work of the Land Division of the Ministry. The Report includes, *inter alia*, sections dealing with proceedings under the following Statutes: Small Holdings and Allotments Acts, 1908 to 1926; Small Holding Colonies Acts, 1916 and 1918, and the Sailors and Soldiers (Gifts for Land Settlement) Act, 1916; Improvement of Land Acts; Copyhold, Inclosure, Commons and Property Acts; Universities and College Estates Act, 1925; Glebe Lands Act, 1888; Agricultural Holdings Act, 1923, and the Ministry of Agriculture and Fisheries Act, 1919. Other miscellaneous activities of the Ministry which are reported include those connected with (*a*) land pests (particularly rats and mice); (*b*) certificates as to agricultural cottages in certain cases; and (*c*) the destruction of injurious weeds.

The brief section dealing with small holdings provided by county and county borough councils includes some general observations on the economic aspect of the small holdings movement; and a section of the Appendix contains interesting data showing the increased production, and the growth in population and labour employed, that result normally from the conversion of large farms into small holdings.

The section dealing with the Ministry's direct activities in connexion with land settlement shows in concise form the position of (*a*) the profit-sharing farms at Patrington and Amesbury, and (*b*) the Small Holdings Settlements still retained by the Ministry.

* The Report is obtainable, from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, and provincial branches, or through any bookseller, price 3s. 6d., post free 3s. 8d.

So far as allotments are concerned, the Report reviews the position as revealed by the statistical returns received from allotments authorities in England and Wales. The figures afford evidence that the somewhat rapid withdrawal of land brought into use for allotments during and immediately after the war has definitely slackened.

Another section of the Report deals with the Improvement of Land Acts, which enable landowners to execute various improvements of land by means of charges on their estates. This section is interesting inasmuch as no report on this subject has been issued since 1914. It includes a brief review of the various enabling Acts and a list of the authorized improvements.

A further section of the Report is devoted to the subject of the extinguishment of manorial incidents consequent upon the coming into operation on January 1, 1926, of the Property Acts, 1922 and 1924, whereby every parcel of copyhold land was enfranchised and ceased to be of copyhold or customary tenure.

The Report also includes a section dealing with the inclosure and regulation of commons, and explains the important provisions of the Law of Property Act, 1925, whereby rights of access to urban commons for air and exercise were conferred upon members of the public, and the construction of fences or other works impeding access to any common was made unlawful except with the consent of the Minister.

The latest report on the proceedings under the Universities and College Estates Acts and the Glebe Lands Act related to the year 1914, and the present Report gives particulars of the transactions effected under those Acts since that date. Reference is made to the exceptional sales of college property in some of the post-war years owing to the boom in land and property values.

The Ministry's duties under the Agricultural Holdings Act are explained, and statistics are given of the number of arbitrators appointed by the Ministry in each year since 1914.

The Report deals also with the constitution of agricultural committees established in accordance with the provisions of the Ministry of Agriculture and Fisheries Act, 1919, reference being made to the number of women members and representatives of agricultural labour on the committees.

One of the more interesting sections included under the heading of " Miscellaneous Activities " is that devoted to the subject of the destruction of rats and mice. The provisions of the Rats and Mice (Destruction) Act are explained, and

references are made to the Ministry's cinematograph films, sets of lantern slides and exhibit, which are available for loan to local authorities. An account is also given of experiments carried out on behalf of the Ministry with red squill baits, and an interesting comparison is made of the effects of this poison upon rats and fowls.

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State of Agriculture: Deputation to the Minister

ON January 23, the Minister of Agriculture (Rt. Hon. Walter Guinness, D.S.O., M.P.) received a deputation from the National Farmers' Union, which placed before him the difficulties with which the agricultural industry is at present faced, and in particular referred to the high cost of labour owing to the operation of the Agricultural Wages Act. The members of the deputation were: Mr. Thomas Williams (Montgomeryshire), Mr. David Black (Suffolk), Mr. Sunley (Yorkshire, E. Riding), Captain Morris (Herts), Mr. Street-Porter (Cambs), Mr. H. German, Mr. Garton, Mr. Baxter, Mr. Robbins, Mr. Slade, Mr. Langford, Mr. Jenkinson, Mr. Guild (Secretary).

The deputation was introduced by Mr. Thomas Williams, the President of the Union, and the chief spokesman was Mr. David Black (Chairman of the Labour Committee of the Union), who was supported by the other speakers: Mr. Sunley, Captain Morris, Mr. Street-Porter, and Mr. German.

In replying to the deputation, Mr. Guinness stated that he was impressed by the strength of their case and the moderation with which it was put, and he promised to take an early opportunity of laying it before his colleagues in the Government.

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The Recognized Grades of Milk

THE following grades of milk are recognized under the Milk and Dairies (Amendment) Act, 1922: (1) "Certified," (2) "Grade A Tuberculin Tested," (3) "Grade A," and (4) "Pasteurized." There is also ordinary milk (ungraded), for which the price ruling for "milk" at the moment has to be paid. The first and most expensive class of milk is Certified Milk, which is obtained from special dairy herds which are under regular veterinary inspection, and which are found not to react to the tuberculin test. This milk must be bottled on the farm, must be sold in the raw (*i.e.*, unpasteurized) state, and must not contain more than

30,000 bacteria to one cubic centimetre, or show the presence of *Bacillus Coli* in one-tenth cubic centimetre on delivery to the customer. It is obtainable from most milk retailers, though it can only be produced on a farm for sale as Certified Milk if a licence has first been obtained from the Ministry of Health.

The second class of milk—" Grade A Tuberculin Tested "—is produced from cows which are subject to veterinary inspection and do not react to the tuberculin test. It must also be sold in the raw state. It differs from Certified Milk in that it may be sent by rail in sealed churns to be bottled at the dealer's premises, and must not contain more than 200,000 bacteria per cubic centimetre, and *Bacillus Coli* must not be present in one-hundredth of a cubic centimetre on delivery to the consumer. A licence for its production is also obtainable from the Ministry of Health.

Plain " Grade A " milk is produced from cows which are also subject to veterinary inspection ; it may be sent by rail in sealed vessels to be bottled on the dealer's premises, and may be sold either in the raw state as " Grade A " milk, or after pasteurization as " Grade A Milk Pasteurized." If it is sold in the raw state it must not contain more than 200,000 bacteria per one cubic centimetre, or show the presence of *Bacillus Coli* in one-hundredth of a cubic centimetre on delivery to the consumer. If it is sold as " Grade A Milk Pasteurized " it must be retained at a temperature of not less than 145 degrees F., and not more than 150 degrees F., for at least 30 minutes, and must then be immediately cooled to a temperature of not more than 55 degrees F. Such milk must not contain more than 30,000 bacteria per one cubic centimetre, and must not show the presence of *Bacillus Coli* in one-tenth of a cubic centimetre on delivery to the consumer. Licences for its production can be obtained from the local authority.

" Pasteurized Milk " is milk which has been pasteurized under certain specified conditions, and must contain not more than 100,000 bacteria per one cubic centimetre. The milk must not be pasteurized more than once and must not otherwise be treated by heat. Licences to produce this milk can also be obtained from the local authority.

Although the number of licences issued, during the period 1923-25, was comparatively small, there was a steady, if slow, increase in the numbers held at the end of each quarter. More recently, however, the increase has been more rapid, as is indicated by the comparative tables shown below for

producers' and dealers' licences issued in England. The total amount of milk dealt with by the licencees for Certified, Grade "A" (T.T.), and Grade "A" milk is still small compared with the total milk production of the country, but it is apparent that, if the recent rate of increase is maintained, these "graded" milks will soon have taken a position of importance in the milk supply of the nation.

The reports received from time to time show that the work carried out in connexion with County Clean Milk Competitions has a considerable bearing on the increase in the number of producers' licences issued, particularly in regard to Grade "A."

These competitions are a means of proving to producers that compliance with Grade regulations is not beyond them. This is well illustrated by reference to the fact that two out of every three samples of milk taken from the 1,062 producers during the course of last year's Clean Milk Competitions in England and Wales reached the bacteriological standard required for Grade "A" milk. It will, therefore, be understood that the number of Grade licences issued is by no means a measure of the amount of milk produced in this country that is, in fact, fulfilling the essential requirements of the Grade Regulations. As soon as the public has been educated in respect of milk, the producers will take up licences.

PRODUCERS' LICENCES—ENGLAND

	Licences issued and in force up to September 30, 1926.	Licences issued and in force up to September 30, 1927.
Certified	107	129
Grade "A" (T.T.) Bottling	12	22
Grade "A" (T.T.) Non-bottling	97	132
Grade "A"	205	328

DEALERS' LICENCES—ENGLAND

	Licences issued and in force up to September 30, 1926.	Licences issued and in force up to September 30, 1927.
Certified	758	913
Grade "A" (T.T.) Bottling Establishments	90	134
Grade "A" (T.T.) Shops	590	758
Grade "A" Bottling Establishments	94	156
Grade "A" Shops	473	710
Grade "A" (Pasteurized) Shops	—	20
Pasteurized — Pasteurizing Establishments	94	141
Pasteurized — Shops	553	647

Marketing Demonstrations at Agricultural Shows, 1928

THE practical demonstration of improved methods of marketing, including packing and grading, which was an essential feature of the Ministry's programme of marketing work at agricultural shows last year, will be continued during the present year. A list of the shows at which demonstrations will be given during the coming summer, and the commodities to be dealt with at each, is appended. Proposals in regard to shows later in the year will be given in a later list, when arrangements are more fully matured.

Date	Show	Place	Sections to be demonstrated
May 11-12	Wharfedale	Otley, Yorks	Eggs and poultry
,, 15-16	Wiltshire	Salisbury	Pigs
,, 22-26	Bath and West and Southern Counties	Dorchester	Eggs and poultry
,, 23-24	Essex County	Chelmsford	Fruit
,, 30 to June 1	Devon County	Exeter	Eggs and poultry, fruit, pigs
June 7-8	Suffolk	Bury St.Edmund's	Pigs
,, 8-9	Leicestershire	Leicester	Eggs and poultry
,, 12	Cambridge and Isle of Ely	March	Potatoes
,, 13-14	Royal Cornwall	Bodmin	Pigs
,, 13-14	Staffordshire	West Bromwich	Eggs and poultry
,, 27-28	Royal Norfolk	Norwich	Eggs and poultry, fruit, pigs, cattle
,, 27-29	Lincolnshire	Scunthorpe	Potatoes
July 10-14	Royal	Nottingham	Eggs and poultry, fruit, pigs, potatoes, cattle
,, 18-20	Great Yorkshire	Halifax	Potatoes
,, 25-26	Tunbridge Wells	Tunbridge Wells	Eggs and poultry, cattle
August 2-6	Royal Lancs.	Oldham	Pigs, potatoes
,, 8-9	Taunton Deane Horticultural	Taunton	Fruit
,, 8-10	Royal Welsh	Wrexham	Eggs and poultry, cattle

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The Draft Fertilizers and Feeding Stuffs Regulations, 1928

SHORTLY after the Fertilizers and Feeding Stuffs Act, 1926, became law, an Advisory Committee was set up by the Minister of Agriculture and Fisheries and the Board of Agriculture for Scotland, for the purpose of preparing recommendations as to the Regulations to be made under that Act. These Regulations have now been published in draft form, and copies can be obtained from any branch of His Majesty's Stationery Office or through any bookseller, price 9d., excluding postage.

The draft Regulations deal with the manner of marking parcels, methods of sampling and analysis, forms of registers and analysts' certificates, limits of variation, and certain other matters which have to be prescribed in accordance with the Act. Any observations or suggestions with regard to them should be sent to reach the Ministry not later than March 23, 1928.

In announcing the issue of these draft Regulations, the Minister and the Board state that it is proposed to bring the Act into operation on July 1, 1928.

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The Empire Marketing Board and the Home Producer

IN a recently issued pamphlet* the Empire Marketing Board sets out, at length, its direct or indirect activities on behalf of the home producer. Every Dominion and Colony has gladly recognized that home agricultural produce has the first claim upon every buyer in this country. The Empire Marketing Board accordingly invites the public, in its daily shopping, to demand, first, the produce of this country and, next, the produce of the Empire beyond the seas. The public is continually reminded, by Press advertisements and posters issued by the Board, as well as by displays at exhibitions and shopping weeks, that the fields and farms of home are none the less a part of the Empire because they are near and familiar.

The general publicity policy of the Board is not so much to point the merits of particular sorts of home produce, as to create a background in favour of Empire buying, against which producers and their Associations can throw into effective relief the fine qualities of the produce which they are setting before the public. Nevertheless, at the request of the Ministry, the Board has included in its advertising many direct advertisements of home produce. These have borne special reference to milk, cheese, butter, poultry, eggs, bacon, beef, mutton, pork, fruit, vegetables, and flour. The Board is now in consultation with the Ministry and with farmers' and distributors' organizations, with a view to a special joint campaign in favour of liquid milk consumption.

* *The Empire Marketing Board and the Home Producer.* Copies of this interesting pamphlet can be obtained free on application to the Empire Marketing Board, 2 Queen Anne's Gate Buildings, Dartmouth Street, S.W. 1.

The publicity side of the Board's work is constantly before the public eye, but it should be remembered that most of its activities lie behind the scenes, in (1) the improvement of marketing methods, and (2) scientific research.

In regard to (1), the marketing work, so far as England and Wales is concerned, is in the hands of the Ministry, the Board having made a grant of £40,000 per annum for five years for this purpose. Full details of the manner in which this grant is being used have appeared in this JOURNAL from time to time.

In regard to (2), scientific research is being initiated or aided by the Board in many parts of the Empire, but, since this subject is more highly developed at home than in most Empire countries, a high proportion of the grants so far sanctioned has been made to home institutions. These grants cover such diverse subjects as Animal Breeding at Cambridge and Edinburgh Universities; Pasture Research at Aberdeen and Aberystwyth; Dairy Research at Reading; Fruit Research at East Malling and Long Ashton; Cold Storage work at Cambridge and East Malling; and Entomology at Farnham Royal and Cirencester.

With the object of supplying accurate and reliable information as to marketing conditions, the Board is now issuing a series of "Weekly Fruit Intelligence Notes," which provide as complete information as possible regarding actual and prospective supplies of fruit in the United Kingdom, together with fruit crop prospects and yields in other producing countries. They also contain full information, each week, as to the imports of fruit into the principal ports, and advice regarding the probable date and port of arrival of steamers carrying fruit to this country. Arrangements have been made to extend this service to cover potatoes and tomatoes. These "Notes" are printed in the Trade Press circulating amongst home producers, and copies are supplied on application to individual growers and co-operative societies.

Finally, the Board has made a grant to the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland for the establishment in London and Glasgow of quarantine stations through which cattle may pass, unchecked by foot-and-mouth disease restrictions, to the oversea markets of the Empire. This scheme, therefore, aims at helping, at the same time, both the home producer and the farmer in other parts of the Empire.

The Ministry

"THE most human of all Departments" is how Sir Francis Floud describes the Ministry of Agriculture and Fisheries in one of the latest additions to the "Whitehall Series" of books on Government Departments.* Sir Francis, who was Permanent Secretary to the Ministry from 1920 to 1927, has given in this volume an interesting and valuable account of the growth and manifold activities of a Department which, he points out, has functions not only in relation to matters purely agricultural and purely fishery, but is also concerned in some degree with education, research, labour, local government and health, and statistics.

It is interesting to note the origin and development of a Department which to-day covers such a wide field. The first Board of Agriculture, founded by Sir John Sinclair in 1793, was not, strictly speaking, a Government Department. It was a Society founded by Royal Charter, and its true successor is the Royal Agricultural Society of England rather than the Ministry of Agriculture. Sir Francis traces the pedigree of the Ministry itself back to the appointment in 1836 of the Tithe Commission. From that date there was a steady increase in the functions assumed by the State in relation to agriculture, and when in 1881 it was urged that a separate Agricultural Department should be constituted, it was pointed out that Cattle Diseases were under the President of the Council, Agricultural Statistics under the Board of Trade, Woods and Forests under a separate body of Commissioners, while a Bill on Agricultural Holdings had been placed in charge of the First Lord of the Admiralty. The appointment of an Agricultural Department of the Privy Council in 1883, the creation of the Board of Agriculture in 1889, the addition of Fisheries in 1903, and the change of title to the Ministry of Agriculture and Fisheries in 1919, bring the history of the Department up to date.

An insight into the working of the departmental machinery is afforded by the chapters on organization and staff, which describe the work of the seven divisions into which the Ministry is divided, the method of dealing with the immense mass of correspondence which passes through a Government Department in these days—the Ministry receives over one

* *The Ministry of Agriculture and Fisheries.* By Sir Francis Floud, K.C.B. (Putnams. 7s. 6d. net.)

and a-quarter million communications a year, and dispatches about two million—and the character of the staff, administrative, clerical and technical, which the Ministry requires to carry out its wide range of duties.

The succeeding chapters indicate how wide that range is. Sir Francis gives an account, not only of the statutory duties of the Ministry, but of the origin and purpose of the various schemes for the development of agriculture and fisheries which are administered by the Department. The functions of the Ministry in relation to the control and eradication of diseases of animals, the teaching of agriculture, agricultural research, live stock improvement, small holdings and allotments, horticulture and plant diseases, beet sugar, rural industries, agricultural economics, tithe and inclosures, agricultural labour, land drainage and commercial control are all described. There are sections on Kew Gardens and the Ordnance Survey, and Mr. H. G. Maurice, Fisheries Secretary to the Ministry, contributes a chapter on the Fisheries Department.

In the "Tribute from *Punch*," with which Sir Francis concludes his book, it is asserted that

> "The Ministry of Ag. and Fish
> Does everything that one could wish
> To foster, guide and chaperon
> Those industries it calls its own."

Perhaps it is too much to expect that this high claim should receive universal endorsement, but those in doubt are recommended to read Sir Francis Floud's book.

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Clover Seed Frauds

PROCEEDINGS taken by the Ministry of Agriculture and Fisheries against H. J. C. Knight, a seed merchant of Bromley, in connexion with the sale of a quantity of seed described as genuine Kentish wild white clover, but which was, in fact, seed of foreign or New Zealand origin, were completed at the Kent Assizes on February 20, when Knight was sentenced to 12 months' imprisonment in the second division, and was ordered to pay the costs of the prosecution, amounting to about £300.

Sheep Scab Order of 1928

THE Minister of Agriculture and Fisheries has recently issued a new Sheep Scab Order, which will come into force on April 1, 1928. It consolidates the provisions of the existing Orders, which are revoked, and makes minor amendments in the procedure for dealing with the disease. The new Order continues the obligation of any person having possession or charge of sheep to report suspected cases of the disease, and also the prohibition against exposing diseased or suspected sheep for sale at a market or other public or private place, or in a lair where sheep are commonly placed before or after sale. It also continues the prohibition against diseased or suspected sheep being carried or driven by rail, road or water, or being kept on common or unenclosed land, or on the sides of a highway, road or lane.

A new feature in the Order is the provision for appeal to the Minister by a sheep owner against the diagnosis of the Veterinary Inspector of the Local Authority as to the existence of sheep scab amongst his sheep. Such an appeal must be made within three days after the date of the Veterinary Inspector's report, and must be accompanied by a certificate of a Veterinary Surgeon employed by the owner. The appeal will then be referred to the Chief Veterinary Officer of the Ministry of Agriculture and Fisheries, whose decision in the matter, after due inquiry, will be final.

In confirmed cases, the owner is required by the new Order to treat the sheep in accordance with directions to be given by the Veterinary Inspector of the Local Authority, which treatment must, however, include double dipping in an approved sheep dip. In severe cases the Veterinary Inspector may require the affected parts to be specially hand-dressed before the sheep are dipped.

The usual requirements in regard to "Movement Areas" and "Double Dipping Areas," declared by special Order of the Minister in districts where sheep scab is prevalent, are embodied in the new Order.

The powers of Local Authorities to make regulations as regards the notification and dipping of sheep brought into or moved within their district are set out, and also their powers to require the compulsory dipping of all sheep in their districts. The use of an arsenical dip for the second of the two dippings required by the Order is prohibited, and the labelling and sampling of dips is regulated.

The returns of sheep scab for the whole of Great Britain for the past year show no evidence of a reduction of the disease. It is, therefore, incumbent on all concerned to do their utmost to improve the position. This disease is one which can be cured and prevented, but only if the necessary measures are properly applied by the farmer himself. Sheep owners are, therefore, especially appealed to in their own interests, and in the interest of their brother farmers, to assist the purpose of the Order by keeping their flocks under close observation, and by carrying out the regulations conscientiously and thoroughly.

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Agricultural Research in Queensland

THE Queensland "Primary Produce Experiment Station Act," of 1927, empowers the Governor in Council to establish and equip primary produce experiment stations. The purposes of such stations are "for conducting experiments (including soil analysis) in connexion with such primary produce, for the treatment of by-products thereof, for the prevention of the spread of disease in connexion therewith, and otherwise for promoting the successful cultivation of such primary produce." Moreover, the stations may be used for experiments directed towards the improvement of the class of primary produce, the production thereof, the dissemination of information regarding their proper cultivation, and generally for the well-being of the grower and the industry concerned.

The Act establishes a "Primary Produce Experiment Stations Fund" for financing the work of the stations. Grants in aid of the Fund will be made from Consolidated Revenue at a rate not exceeding £ for £ against income from "assessments." Assessments may be levied on the grower of primary produce, calculated on produce grown for sale, in connexion with which an experiment station has been established. The Fund will be apportioned among the experiment stations as the Government may decide. A portion of the Fund may be applied for the purpose of carrying out inquiries and investigations on the control or eradication of pests and diseases.

NOTE.—At the Imperial Agricultural Research Conference, 1927, it was announced that the Government of the Australian Commonwealth was willing to undertake the responsibility of establishing in Queensland one of the links in the chain of

research stations that will ultimately engirdle the Empire. It has agreed to undertake the obligation of financing the station and providing with the Empire Marketing Board a sum of £50,000 for capital expenditure and £10,000 per annum for maintenance of the Imperial Station.

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Marketing of Home Produce : Report

ACCOUNTS have been given in this JOURNAL, from time to time, of the various activities undertaken by the Ministry with the aid of the grant of £40,000 a year for five years, which has been made by the Empire Marketing Board. This grant was given for the purpose of carrying out investigations into the marketing of home-grown agricultural produce and for demonstrating improved methods. A further brief report of progress for the three months ended December 31, 1927, may prove of interest.

Publications.—Part II of the "Survey of Markets" (Midland Markets—Economic Series, No. 14) and the "Report on the Fluid Milk Market" (Economic Series, No. 16) have been published, and have met with a very favourable reception. One dairy firm alone purchased 5,000 copies of No. 16 for distribution to its suppliers. A report on "The Pork and Bacon Trades" (Economic Series, No. 17) is being prepared for the printer. The preparation of other reports is in progress.

Sales of reports in the Economic Series during the three months under review totalled 9,803 copies, bringing the total sales of the series up to December 31, 1927, to over 47,700.

Marketing Investigations.—Investigations into the marketing of cheese and vegetables continues. Field work in connexion with the marketing of cattle has been completed. The inquiries necessary in the eastern and southern counties for the purposes of a report on the markets and fairs of that area are well advanced.

Marketing Demonstrations and Displays of Empire Produce.—A considerable amount of work in both these directions was undertaken during the quarter, detailed accounts of which have already been given in this JOURNAL. An addition to the published programme of demonstrations was a fruit marketing demonstration arranged by the Ministry at Swanley, Kent, in December, as a result of which a promising scheme is now under consideration by local growers for the establishment of a packing station in that area.

Grants-in-Aid.—A grant of £530 per annum for two years has been made to the University College of Wales, Aberyst-

wyth, to enable certain investigations into marketing to be undertaken. Arrangements have been made to correlate this work with the investigations being undertaken by the Ministry's own staff.

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Grants to Institutions Providing Higher Agricultural Education

THE Report of the Departmental Committee on the re-assessment of annual grants to Institutions providing higher agricultural (including veterinary) education in England and Wales has now been issued. The report has been accepted by the Ministry, and the grants which the Committee recommended have been approved by H.M. Treasury. The table below shows the grants recommended during the next three years :—

Institution	Grant recommended £
University College of Wales, Aberystwyth University College of North Wales, Bangor	7,000[1]
University of Cambridge	6,500
University of Leeds	3,800
Armstrong College, Newcastle-upon-Tyne	3,500
University of Oxford	4,000
University of Reading	4,000
South-Eastern Agricultural College, Wye	4,000
Midland Agricultural and Dairy College	3,000
Harper Adams Agricultural College	4,000[2]
Harper Adams Agricultural College: National Institute of Poultry Husbandry, not exceeding	2,500[3]
Seale Hayne Agricultural College	2,300
Royal Agricultural College, Cirencester	2,000[4]
Studley College	1,000
Swanley Horticultural College	1,750
British Dairy Institute, Reading	900
Royal Veterinary College	3,300
University of Liverpool	1,850[5]
Total	£55,400

[1] To be allocated after discussion with the University of Wales.
[2] An additional grant to be payable in 1928.
[3] The grant to the National Institute of Poultry Husbandry to be the subject of an annual application to the Ministry.
[4] To be reviewed after a year.
[5] When the Animals' Hospital is built and occupied the grant may be increased.

The Committee, in their report, make several suggestions as regards courses, extra-mural work, local conferences, etc., for the consideration of the various Colleges.

The report is published by H.M. Stationery Office, and copies can be obtained by persons interested at 1s. 6d. each, net.

ADDRESS TO THE ARGENTINE RURAL SOCIETY

By THE RT. HON. LORD BLEDISLOE, P.C., K.B.E.

This Address was delivered to the Argentine Rural Society on January 12, 1928, during a visit to Argentina made by Lord Bledisloe, then Parliamentary Secretary to the Ministry, on behalf of the British Government.

GENTLEMEN,—I am delighted to accept your generous invitation to visit your Society's handsome premises and to have this opportunity of discussing with you the object of my mission to your country on behalf of the British Government.

I venture to speak to you this evening not merely as Deputy Minister of Agriculture in the British Government, but also as a large-scale farmer and stock-owner in England who carries on the business of farming on commercial lines, and who realizes the many difficulties and handicaps in connexion with the prices of live stock and land produce, the weather, and the various diseases which afflict both our crops and our farm animals. I can only express the hope and belief in this connexion that you, as farmers, have not been passing through the period of extreme depression and financial loss which, unfortunately, has been the lot recently of most farmers in my country.

Let me in the first place express my deep appreciation of the extreme friendliness with which I have been received on all sides from the moment that I landed in Argentina, at the hands of the President of the Republic, of various members of your Government, including especially your Minister of Agriculture, and of numerous estancieros, several of whose estancias I am hoping to visit before I return to England.

My official mission to your country is, as you know, in connection with "aftosa," or, as we call it, foot-and-mouth disease, the suppression of which in both our countries is calculated to reduce the trade losses and anxieties of their respective stock-owners, and enhance the measure of friendly confidence which, more than anything else, is conducive to the development of international trade.

The announcement of my forthcoming visit to the Argentine caused, I am well aware, deep anxiety and apprehension on the part of many Argentine estancieros, who were under the impression that it might lead to an embargo being placed upon

the importation of Argentine chilled beef into Great Britain, to the serious detriment and possible ruin of the stock-owning interests of this great agricultural country. I want to assure you that you need not at present entertain any such apprehensions. The case in regard to the possible transmission of the virus of aftosa would have to be serious indeed to justify any such embargo being imposed upon one of the main sources of food supply to my country. As you are possibly not aware, Argentine meat is estimated as representing about 48 per cent., or nearly half, of the total meat consumption of our British urban populations, including that of London, as compared with 25 per cent. only derived from British farms and 20 per cent. from other parts of the British Empire. Let me take this opportunity of telling you, with the utmost frankness, that I hope and believe that the proportion of our meat supply which will come in future from within Great Britain and the British Empire will be largely increased. But even then, there is bound to be, with our large and ever-increasing population, a considerable balance which will have to be bought from other countries, and in the keen and friendly competition which is bound to take place in this as in other vital commodities, the victory will undoubtedly rest with those who are prepared to profit by the carefully ascertained results of scientific research, especially in regard to disease.

It is calculated that even in our temperate climate the losses from fungoid disease and insect pests amount to, in relation to our economic plants, from 12 to 20 per cent. of their total value, and I have little doubt that in sub-tropical areas, such as are comprised within the boundaries of your vast country, the loss from these sources is at least double that amount. You have good reason to know what such losses involve, with your unfortunate experiences in connexion, let me say, with red rust in wheat and the corn-borer in maize. What are the corresponding losses in connexion with animal diseases it is difficult to estimate. As in my own country, so to an even greater extent in yours, tuberculosis, contagious abortion, sheep-scab and hog-cholera are pests which especially reduce the trading profits of many stock-owners.

Perhaps the most insidious and inscrutable disease, and the one most difficult to control, is aftosa, or foot-and-mouth disease. The disease is caused and spread, as many of you know, by an ultra-microscopic and filtrable virus, which has not yet been separated and identified, and no effective preventive inoculation has yet become possible as the result of the

research work of our scientists. But their researches have at least made it evident that the chilling or freezing of carcasses is not effective in destroying the vitality of the disease-germ, and that it can, in fact, live in the bone-marrow of a chilled carcass for more than 60 days, and on the surface of the skin for at least four or five days, with the consequent danger of such carcasses becoming the carriers of the disease from the Argentine to distant countries like Great Britain. It is true that the disease here is endemic, and generally of a moderate or "benignant" type, and consequently not regarded with the same gravity as we regard the disease in my country. But it is quite possible for a mild type of aftosa to develop by transmission a virulent type in another country. It is this more virulent type to which we are accustomed when outbreaks of the disease occur, and in the interests of our valuable live stock industry we have found it advisable to deal with the disease in the most drastic fashion when outbreaks occur, by the process of immediate slaughter, with Government compensation, not merely of all affected animals, but of all those which may have been brought into contact with them.

This drastic policy has enabled us in the past (and I speak as one who in days gone by has sold valuable Shorthorns at good prices to Argentine estancieros) to enjoy your confidence as exporters to the Argentine of high-class pedigree stock of every description, especially cattle, guaranteed to be free from all serious infectious diseases. What we are asking now on your part is that you will be willing, through the medium of your Government, to accept such conditions as will prevent, as far as possible, animals affected with aftosa from passing from your estancias into the Frigorificos, or—if the disease can only be detected after reaching the latter—from being transported through the medium of chilled carcasses to Great Britain.

I fully recognize the difference in the conditions prevailing in this country and my own, especially in the matter of the relative sizes of farms and fields, and the long distances that live stock have to travel from the places where they are fattened to those where they are killed, and I realize that it would be unfair, and, indeed, ineffective, to attempt to apply to this country the same drastic regulations which have to be imposed under similar conditions in Great Britain. It is obvious that nothing is gained by inserting in a decree or in Government regulations stipulations which are so unreasonable or locally so impracticable as to encourage their breach or render the imposition of penalties impossible. What is far more satis-

factory, from our point of view as well as from yours, is for us to agree, as I feel sure that we shall, upon such conditions as, without being too drastic, will effect our purpose and will be accepted and enforced without hardship to any of the interests concerned. And this leads me to make an appeal to the Executive Committee of this powerful and influential organization of Argentine Estancieros.

Your kindly disposed Government can do much to help us in this matter, but *your* sympathetic co-operation is essential to the success of any action which they are prepared to take.

If the leading estancieros of Argentina, as represented by your society, will make it a matter of honour and conscience to prevent any cattle affected with aftosa passing from their estancias to the Frigorificos—in other words, "point the way" to effective compliance among all estancieros with our British requirements—it will, I am sure, render more effective the proposed Government regulations, ensure faithful adherence to them, and evoke the full confidence of the British Government and the British agricultural community.

I hear that your business of cattle raising has not lately yielded you the profits which you enjoyed a few years ago. This, no doubt, is partly due to the reduced purchasing power of the British working population consequent upon industrial depression and the coal strike of 1926. The "Meat War" in this country has also tended here, as it has (much more seriously) in England, to reduce the price of meat below the cost of its production. The prospects for the present year are in all respects more hopeful for cattle breeders, on both sides of the Atlantic, especially if your meat traders will avoid "Meat Wars," and if we are to enjoy in Great Britain a cessation from the industrial strife which has in recent years caused or accentuated widespread industrial depression. But the producers of meat on both sides of the Atlantic have to realize, if they are to obtain the full fruition of their enterprise, that the taste of the British consumer has substantially changed in recent years. The demand now is for "baby beef" and small joints, the produce of relatively small early maturing animals. I have seen some excellent animals of this type and of all the best known beef breeds in the corales adjoining your Frigorificos. I see no reason why, if you study the changing taste of your British customers, you should not enjoy in the future the same prosperity as you have in the past. I thank you sincerely for your hospitality and kindness.

THE DOWNY MILDEW OF THE HOP IN 1927

Prof. E. S. SALMON and W. M. WARE, M.Sc.,
South-Eastern Agricultural College, Wye, Kent.

DURING the summer of 1927, a long and continuously wet period in July and August brought about very serious injury to the hop crop by Downy Mildew in certain of the hop-growing counties. Over a very large acreage, a general browning of the hop cones was caused just before or during picking time, and in some cases to such a degree that the hops were left unpicked as worthless. The probability of wet weather playing an important part in fostering a general outbreak of Downy Mildew on the cones was pointed out in 1923.[1] Further, the experience gained from the course of events during the past season has shown that the measures of control of the disease which may be sufficient in dry seasons are inadequate in wet, and need to be supplemented by spraying[2] with a fungicide, as has already become the practice in certain districts on the Continent.

The following article contains (1) a brief account of the course of the disease in this country in 1927; (2) a consideration of the sources of infection in connexion with the control of the disease by spraying and other measures; and (3) an estimate of the losses caused.

The Disease in 1927.—The course of events may be summarized as follows: "Spiked" shoots arising from the hill were observed in hop gardens in Kent from the beginning of April onwards. There is evidence that many growers now recognize this stage of the disease, so that in their hop gardens "spike" pulling or cutting has become a routine practice. The following is an extract from one of many letters received: "In the garden of Tutshams, which was affected during the last three seasons, exceptionally so in 1925, this year, in the spring, no more than about one spike in a hundred hills was found during training, and none at all afterwards. With us

[1] "Three New Diseases of the Hop:" E. S. Salmon and H. Wormald, this JOURNAL, August, 1923, p. 433; and "The Downy Mildew of the Hop:" E. S. Salmon and W. M. Ware, this JOURNAL, March, 1925, pp. 1145 and 1151.

[2] That spraying might become a necessity was pointed out in this JOURNAL, March, 1925, p. 1150. [See also paragraph 2, with footnotes 10 and 11, on p. 1097.]

this year the dry April and May appeared to check effectively the spread of Downy Mildew."

The "spike" form of the disease was received not only from many districts in Kent and Sussex, but also from Hampshire, Worcestershire, and Herefordshire. Everywhere the disease appeared to be temporarily checked during an early spell of dry weather,[3] and basal and terminal "spikes" do not appear to have been so numerous in 1927 as in 1926. No great attack developed during the following months but, as a result of the very wet weather[3] of July and August, cases

RAINFALL (inches)

1927	WYE (East Kent)	EAST MALLING (Mid Kent)	Normal S.E. England	Deviation from normal	
				WYE	E. MALLING
March ..	3·16	3·11	2·05	+ 1·11	+ 1·06
April ..	1·63	1·58	1·69	− 0·06	− 0·11
May ..	0·77	0·84	1·77	− 1·00	− 0·93
June ..	3·27	3·73	1·89	+ 1·38	+ 1·84
July ..	5·29	3·96	2·17	+ 3·12	+ 1·79
August ..	3·42	4·57	2·32	+ 1·10	+ 1·25
September	3·19	4·76	2·13	+ 1·06	+ 2·63

of the crop suddenly turning brown came under our observation day after day. Hundreds of acres were affected, and it is safe to say that no such sudden and widespread outbreak has been known before in this country.[4] Among the varieties most attacked (in some cases to such an extent that they were not picked) were Bramling, Early Bird, Tolhurst, and Prolifics. Other varieties, more or less seriously attacked, were Tutsham, Cobb's, and, in some districts, Goldings. On the other hand, numerous cases have been observed which show that the variety Fuggles is practically immune from injury so far as its cones are concerned—a fact of great interest and economic importance. This resistance was sometimes exhibited under conditions imposing a severe test. Thus, where this variety was grown intermixed with a susceptible variety, the cones of

[3] We are indebted to Capt. A. H. Bird and to Mr. H. C. Chapelow, Observers in connexion with the Ministry's Agricultural Meteorological Scheme at Wye and at East Malling respectively, for the figures of rainfall given in the table.

[4] To those familiar with the history of the disease on the Continent, the state of affairs was reminiscent of that described as existing in Germany in 1926.

the latter became completely brown while those of Fuggles remained green and healthy.

Considerations of space make it impossible to give an account here of the outbreaks during 1927 on the Continent. It may, however, be mentioned that in Germany, where, for several years past, the attacks have been far more severe than in this country, Downy Mildew is being treated as a matter of national importance, and the Reichstag has voted large sums of money for further investigations and for the purchase of spraying machines.[5] In many districts of Germany, Czecho-Slovakia and Belgium, hops were regularly sprayed during 1927 with Bordeaux mixture throughout the growing season. Good results have been reported.

Consideration of the Sources of Infection and of Control Measures.—The course of events in 1927 shows that, in a very wet season, the control measures based on the removal of " spiked " growths, the stripping of the lower leaves, etc., are insufficient to prevent, later, disastrous outbreaks of the disease on the cones. Before passing to the consideration of the practical aspect of spraying, it is important to pay particular attention to the possible sources of infection at the time when the cones are attacked. These are as follows : Spores produced (1) on the upper leaves of the bines in the hop garden ; (2) on the leaves of any " wild " hops adjacent ; (3) in neighbouring infested hop gardens and carried on the wind ; (4) Winter-spores (*oospores*) present in infested soil.

With respect to (4), nothing is as yet known as regards the germination of the winter-spores. It appears unlikely, however, that this source is of importance in relation to the infection of the cones. With regard to (3), there is no definite knowledge as to the distance spores can be transported. There seems no doubt that, with strong winds, spores may be transported, after a period of time, from one end of a hop garden to the other, but it is not known whether spores can be carried in the air from an infected hop garden to a garden at a distance. If this does occur, it would explain why an entire crop may suddenly turn brown, such as happened in certain gardens in 1927. (2) While, undoubtedly, infected " wild " hops are a menace and should be unremittingly sought for and extirpated, they cannot be regarded as providing the

[5] Muck, R. : Die Peronosporakrankheit (Falscher Meltau) des Hopfens. Saaz, 1927. See also *Le Petit Journal du Brasseur*, XXXV, 984, 1927.

entire source of infection for the general attack on the cones. (1) As a general rule, spores of the fungus are to be found on the leaves, often on those which occur on the branches with the hops. It is probable that the original infections of the hop cones are in many cases due to spores produced here, and also in some cases to those on the leaves of "runners" and shoots growing from the hills during the latter part of the season.

It has already been pointed out above that, in this country, it will in future be necessary to spray hops against the disease, and the sprays and methods to be used will now be described. It has been found, as the result of extensive experiments carried out on the Continent, that repeated sprayings with Bordeaux mixture result in protection of the cones.[6] The strength of the mixture used abroad varies from one-half to one per cent., and up to 10 sprayings are commonly given. Growers in this country are advised to proceed on an experimental scale, as, although success is reported from the spraying of hops abroad, it must be remembered that the varieties sprayed were different from those grown in England, and that climatic and other conditions are also different. It is essential that the plants be not drenched, or injury due to "scorching" will result; the spray has therefore to be applied with nozzles giving a fine mist. Full reliance cannot be placed on spraying alone, and it should be carried out as a measure additional to the routine operations hitherto recommended.

The full control measures now advocated are as follows: (1) From April or May onwards the "spiked" shoots must be carefully searched for and removed.[7] Stripping of the lower leaves of the bines should be carried out as soon as it is safe to do so. If shoots arise from the "stripped" bine, these should be removed. Throughout the season the hills should be kept scrupulously clean of all shoots and "runners." (2) All rogue, or "skew," hills which occur commonly in gardens of Tutshams, Bramlings and Fuggles, and which

[6] *Blattny, C.:* Peronospora (Falscher Meltau) des Hopfens in *Travaux des Instituts des recherches agronomiques de la Republique Tchécoslovaque,* Vol. 27a, 1-274 and 297-303. Prag., 1927. *Korff and Hampp:* Die Bekämpfung der Peronosporakrankheit des Hopfens. *Flugblatt* 50 Bayerische Landesanst. f. Pflanzenbau u. Pflanzenschutz. München. Feb., 1927. *Muck, R.:* Die Peronosporakrankheit (Falscher Meltau) des Hopfens. Saaz, 1927.

[7] It is a good practice to collect these in a tin of some such liquid as a weak aqueous solution of lysol or methylated spirits, which will thoroughly wet the "spikes" and prevent dispersal of the spores.

have proved to be extremely susceptible to Downy Mildew, should be grubbed up. (3) All "wild" hops in the vicinity should be grubbed up. (4) The bines should be sprayed with home-made one per cent. Bordeaux mixture[8] (*a*) when they are three-quarters up the strings or poles; (*b*) when they have reached the top; (*c*) just before the plants come into "burr," and (*d*) immediately after the "burr" has gone.

The plants must be sprayed with a fine, mist-like spray which will cover both surfaces of the leaves with fine drops without making them drip to any extent, *i.e.*, they must not be drenched as when "washing" against blight (*Aphis*). As regards the third application, it is particularly important that only a light spraying be given, as otherwise injury may be caused to the "pin." No spraying must be done when the hops are in "burr," as this would injure the "burr" and result in the production of very small seedless cones.[9]

In Germany, where seedless hops only are grown, spraying is carried out while the hops are in "burr" and also when the cones are formed. According to report, the brewing properties of the cones are not affected adversely by the small amount of copper which may be present as the result of spraying.[10] In this country, however, in view of the statement, published recently in this JOURNAL,[11] that mixtures containing copper should not be used on the hop cones, as any copper found in hops would "render them entirely unsuitable for brewing purposes," it is inadvisable that Bordeaux mixture should be used at any time after the cones are formed.

The good results obtained from spraying with Bordeaux mixture are probably due to the fact that spraying protects the upper parts of the bine, so that spores are not produced on the leaves in the neighbourhood of the cones. On unsprayed bines there is likely to be a gradual upward spread of the disease until the cones are reached.[12]

An Estimate of the Losses Caused.—The severe loss caused by the outbreaks of Downy Mildew in 1927 has been two-fold.

[8] An illustrated leaflet describing the life-history of the Downy Mildew, and giving detailed instructions for making and applying the Bordeaux mixture, can be obtained (price 6d.) from the Secretary, Research Department, South-Eastern Agricultural College, Wye, Kent.

[9] Since fertilization of the "burr" by pollen from male hops is essential for the production of well-grown-out cones, care should be taken not to spray male hops coming into flower.

[10] Dr. D. Wiegmann, in *Le Petit Journal du Brasseur*, XXXV, 743, 1927. (Translation from *Zeitschr. f. das gesammte Brauwesen*, 73, 1927).

[11] This JOURNAL, August, 1927, p. 481.

[12] This JOURNAL, March, 1927, p. 1119.

The sudden advent of the disease on the cones before they were fully ripe, created the necessity for immediate picking in a great many cases, whereby loss in weight and condition resulted. Where the cones at picking time had turned brown, the colour of the dried hops suffered considerably, with consequent depreciation in market value, although it has yet to be determined to what extent, if any, their brewing properties have been affected. Where the cones were attacked severely, a somewhat powdery condition was reported in the dried samples, which appeared thinner and less whole than they otherwise would.[13]

Some estimate of the general loss sustained may be formed from the following accounts, amongst others, supplied to us by growers in Kent :—

(*a*) "As to the actual amount of damage sustained in our gardens of Goldings, Bramlings, Tutshams, etc., we estimate that our crop here was reduced by at least 25 per cent. For so unfavourable a season, we had by the middle of August a very fine show of well-grown-out hops, but owing to the severe attack of Downy Mildew, we were compelled to commence picking quite 8 to 10 days earlier than we should otherwise have done, and in consequence right through the picking we were gathering hops that were not fully ready."

(*b*) "Owing to the attack of Downy Mildew, picking here was commenced at least a week before the crop was mature. This quite possibly reduced the crop by 2 cwt. per acre, and I estimate loss of quality to be of the order of £2 10s. per cwt. The difference is therefore between 14 cwt. per acre at £14 (=£196 per acre) and 12 cwt. per acre at £11 10s. (=£138 per acre, showing a loss of £58 per acre."

(*c*) "I consider that I lost at least 33 per cent. of my weight of hops from this disease. The disease struck the hops rather early, and I consider that I lost the bulk of my weight through the under-development of the hops, as when the disease appeared in the cones they stopped growing."

(*d*) "Owing to severe attacks of the Downy Mildew, I left unpicked 5 acres out of 12 acres of Bramlings, and those that were picked were muck. I also had to leave, for the same reason, 3 acres of Cobb's and 3 acres of Tutshams. I lost somewhere about £1,700 worth of hops."

Summary.—1. An account is given of the incidence of Downy Mildew in 1927 in England, and of the resulting discoloration of the hop cones over a large acreage.

2. The injuries caused to the affected crop are described, and estimates given, in certain cases, of the financial losses involved.

3. In the wet season of 1927, preventive measures based on the removal of the sources of infection ("spiked" growths,

[13] See also Waghorn, J. H.: "Hops in Kent and Sussex." *Jour. Inst. Brewing*, XXXIII, 535-6, 1927.

etc.) proved insufficient to prevent a widespread attack on the cones.

4. Spraying with Bordeaux mixture (which has proved to be satisfactory on the Continent) is recommended, and four applications are suggested tentatively.

5. As regards the cones, certain varieties, *e.g.*, Bramling and Tolhurst, have proved to be especially susceptible, while the variety Fuggles, under conditions where it was severely tested, has proved to be practically immune.

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METEOROLOGY AND AGRICULTURE

(*Concluded from p.* 1043)

THE following are brief summaries of the remaining papers read at the Third Conference, arranged by the Ministry, of workers engaged on the study of various aspects of the effect of weather on crop growth, which was held on September 22 and 23, 1927. It is proposed to issue, later, a full report of the Conference, and a limited number of copies will be available for free distribution.

Meteorological Conditions and the Amount and Nutritive Value of Pasture and Hay (Prof. R. G. Stapledon).—Both yield and nutritive value of pasture or hay depend to a very large extent on the stage of growth reached by the plants composing the pasture or meadow at the time they are eaten or cut. This growth stage is determined to a far greater extent by management and by the plant's inherent capacity for growth than by the accident of weather.

Clovers are richer in nutrients than grasses, and a first harvest year pasture crop will be nutritious and bulky largely in proportion as red clover dominates the sward. Meteorological conditions influence the quantity and quality of herbage to the degree that they affect clover dominance. Obviously we cannot have clover dominance unless we have established a good take of clover, so we must go back to the weather conditions of the seeding year. Sowing in August and later is not favourable to clover dominance. For actual germination and initial establishment, mid-temperatures at over 44° F., with adequate but not excessive rain, are most advantageous. Both excessive drought and excessive rainfall appear to make for delayed germination, delayed growth and seedling casualties. Given reasonable establishment during the summer, over-autumning and over-wintering have yet to

be considered. Young clovers are very sensitive to water-logged conditions accompanied by ground frosts, being far more readily uplifted than the grasses. The character of the weather in November when ground frosts are usually frequent, therefore, exerts a considerable controlling influence on subsequent clover dominance. It is exceptional, particularly in the case of red clover, for a heavy hay crop to follow after an exceptionally heavy autumnal development in the seeding year. Consequently, weather exceptionally favourable to growth during September, October, and early November is adverse to heavy clover production in the first harvest year. Two factors come into play: (1) the fact of the clovers having been allowed to flower and reach maturity, and (2) the killing influence of the *Gloeosporium* disease on clovers in such a stage at such a time of the year. Here, however, *management* should have entirely obliterated the response of the clovers to favourable growing conditions—grazing could and should have kept them in place.

The leaf of a grass is richer in nutrients than the stem, therefore there is a natural cycle of nutritive value which is very largely independent of weather conditions. Early in the year the percentage of leaf is much greater than that of stem, and consequently the herbage has a high nutritive value independent of weather conditions. The ratio becomes increasingly in favour of stem as heading stage approaches, and continues until maturity, the nutritive value falling accordingly, though to a slight extent counterbalanced by the flower heads until such time as the seed is shed.

Clovers and grasses attain to maximum productivity at decidedly different times of the year, and clovers require a higher mid-temperature before they start really active growth than do grasses. The precise date at which clover growth fairly starts is far more dependent on temperature than on rainfall. Excess of rain early in the year, although it will make for a measure of grass growth even if the temperature is low, will have practically no influence on clover until the mean temperature also advances considerably.

As regards protein content and mineral content, work at both Cambridge and Aberystwyth has shown that there appears to be a certain seasonal drift, even in the case of pasturage kept closely grazed, so that in this connexion it is only after prolonged study that we shall be able to gauge the influence of weather fluctuations. The available data, however, allow of certain generalizations. The percentage dry

matter in green herbage was definitely higher in dry 1921 than in wet 1923. Dried and browned herbage is, however, less rich in nutrients than green and succulent herbage. A comparison between the monthly pasture cuts of cocksfoot in dry 1921, with high mid-temperatures and excess of sunshine, and in very wet 1923, with very poor sunshine, shows that in the very wet year month-old herbage had a higher leaf to stem ratio than in the dry year, and produced a greater bulk of leaf with a higher protein content. This serves to indicate the influence of extreme weather conditions on the yield and nutritive value of pasture grass. The chief effect of a dry year is undoubtedly to make for slow growth which matures and dries off prematurely, and which will not have the same nutritive value as herbage of reasonable height produced under adequate conditions of soil moisture.

With regard to the hay crop, management rather than weather conditions influences the proportion and nutritive value of red clover in the crop. The data for 1927 are particularly interesting. The crop from a field cut on June 10 was compared with that from a field where cutting had been deferred until July 13, and it was found that the clover contribution had increased from 5 per cent. to 55 per cent. Here the influence of management was much augmented, however, by favourable weather conditions.

The influence of weather conditions on hay yields has been extensively studied in Sweden, and Witte concludes that the yield is chiefly influenced by the amount of rain falling from the time the herbage starts to make really active growth in the spring until the crop is cut—the starting date in the spring being very largely influenced by temperature. During the last seven years the heaviest hay yields at Aberystwyth were taken in those years which were the wettest during the period April to June.

Despite weather conditions, heavy aftermaths do not follow excessive hay crops, while, if weather conditions have been unfavourable to hay production and become favourable to aftermath, the aftermath will be exceptionally heavy. The weather conditions during the aftermath growing periods for late clovers in 1921 and in 1925 were almost identical, yet after the low hay yield of 1921 there was an excessive aftermath yield, while after the high yield of 1925 there was a very low aftermath yield.

Meteorological Conditions and the Rate of Growth of Pasture Grass (Dr. H. E. Woodman).—In this paper are described

the results of investigations on pasture carried out on the Cambridge University Farm in the years 1925 and 1926. The results are discussed mainly from the point of view of the effect of meteorological conditions.

In 1925, an acre plot was selected on light sandy soil (60 per cent. sand, 11 per cent. clay), and in 1926 on stiff Gault clay soil. The plots were sub-divided into seven equal sub-plots, one plot being cut every day throughout the grazing season by a 16 in. lawn mower, *i.e.*, the whole of each plot was cut over weekly. The daily produce was weighed, sampled for chemical analysis, and digestion trials were carried out with sheep. For the last purpose the season was divided into ten periods.

The weather experienced during the two years differed equally with the soil. In 1925 the chief characteristic of the season was a drought in June. In 1926 the rainfall was more copious and was better distributed over the season ; the spring was abnormally cold and wet, there was adequate rainfall during the mid-season, the autumn was fairly dry, and there were night frosts in early October.

In 1925 the pasture on the sandy soil showed signs of awakened activity in the latter part of April and in early May ; this was followed by a fortnight of intense activity (May 11 to 25). During this zenith period nearly 22 per cent. of the season's yield was produced. A steady decline followed, until in mid-July productivity was at its lowest level. There was a subsequent renewal of activity, which led to a continuous improvement in the rate of production of herbage from July 20 to August 10. From the latter date until October 12 the productive capacity was fairly steady, at about one-third of that during the awakening period, and one-fifth of that during the zenith period. As October advanced, productivity fell to a low level maintained until the end of the trial.

In 1926, on the clay pasture, the rate of growth was fairly steady throughout the season. There was no zenith period, and no mid-season drop.

In 1925 the controlling meteorological factor during most of the season was rainfall, due not only to the comparatively poor water-retaining capacity of the sandy soil, but also to the mid-season drought. In 1926, on the other hand, the controlling meteorological factor over the greater part of the season was temperature ; rainfall was not important, (1) because it was sufficient during the greater part of the season, and (2) because

of the superior water-retaining capacity of the soil and the higher water table.

The following details may be given :—

As regards composition and nutritive value, the grass kept short was characterized by a high protein and low fibre content in both years. If, however, conditions favoured a stemmy growth, the content of protein was decreased, and that of fibre increased with a decrease in digestibility. This happened in the mid-season drought period in 1925, but owing to the steady growth in 1926 there was no marked mid-season falling off in digestibility in that year. The light land pasture of 1925 produced nutrient matter at a high rate during the early part of the season, but during the subsequent months, especially during the dry mid-season, the rate of production fell to a very much lower level. In sharp contrast to this behaviour the rate of production of nutrient matter on the clay land pasture in 1926 was fairly uniform throughout the season. No marked peak of productivity was noted during spring, and the most pronounced rise in the rate of production of nutrients occurred towards the end of July ; clay pasture at this period of the 1926 season produced starch equivalent and digestible protein at more than four times the rate at which they were produced in the herbage of the sandy pasture during the corresponding period of 1925. In 1925 the moisture content of the grass varied with the rainfall, but a surprising fact was that a higher moisture content was obtained after dew than after the heaviest rain. As regards mineral content, the maximum lime and minimum phosphate content was obtained during the droughty period.

Temperature and Food Requirements of Animals (Professor T. B. Wood).—It is commonly supposed that animals require more food in cold weather than in the summer. There are, however, very few accurate measurements. Capstick and Wood have recorded a series of accurate measurements of the heat evolution of a pig when at rest and fasting, and when exposed to temperatures varying from 10° C. to 24° C. It was found that the heat evolution was constant from 20° C. to 24° C. Below 20° C. it rose with falling temperature at the rate of approximately 4 per cent. per degree C. Measurements were not made below 10° C., but there is no reason to think that the rate of rise would not continue below this temperature. The reaction of the fasting pig to change of temperature, therefore, changes at 20° C.

The observations were made on the fasting animal. Let us

suppose that an animal is eating 5 lb. of barley meal per day, and that his "basal metabolism," *i.e.*, the heat evolution necessary to maintain his vital processes, is 2,000 calories per day. Now 1 lb. of barley meal produces in the body of the pig 1,460 calories, of which only 1,060 calories can be used for physiological purposes, the balance of 400 calories being necessarily converted into heat during the processes of digestion and absorption. There will result, therefore, from the digestion and absorption of the 5 lb. of barley meal 2,000 calories of heat which can be used for the maintenance of body temperature, but for no other purpose. Since the basal metabolism is 2,000 calories per day, and a fall of temperature of 1° C. causes a rise in basal metabolism of 4 per cent. for maintenance of body temperature, the extra demand for this purpose is 80 calories per degree C. To meet this, there are the 2,000 calories from the digestion and absorption of the food, and this will meet the demand for 25° C., and there will therefore be no need for increased oxidation, and no increase in food requirements until the temperature falls 25° C. below 20° C., *i.e.*, to −5° C. This, of course, assumes that all conditions, except temperature, are the same, which is not true, since the inside of the calorimeter used in the experiments is a much more sheltered position than the commercial pig usually occupies in winter.

The practical conclusion is that fall in temperature only does not directly increase food requirements in the case of full-fed animals under practical conditions. Fall or rise of temperature may do so indirectly by occasioning discomfort, which results in excessive muscular movement.

The Physiological Action of Ultra-Violet Light (Dr. H. E. Magee).—Sunlight has been recognized for a very long time as indispensable for the growth of most of the plants that enter into the dietaries of animals and man. Although apparently not entirely indispensable in a direct sense for animal life, there has been accumulating during the past decade a weight of evidence showing that ultra-violet light has a very important effect upon the growth and health of animals.

Sunlight is a mixture of radiations of varying wave-lengths, partly visible and partly invisible. The commonest artificial sources of ultra-violet rays for health purposes are the mercury vapour, the carbon, and the tungsten arcs.

Before radiations can affect a substance, absorption, resulting in some degree of molecular or atomic change, must take

place. Thus, chemical change in inorganic substances can be brought about and bacteria killed by ultra-violet rays, which also affect the activities of most ferments and enzymes of animal and vegetable origin.

Ultra-violet rays can only penetrate the human skin a minute distance; their physiological action must therefore be brought about by affecting the cells in the superficial layers of the skin. They are impeded by clothing, fog- and smoke-laden atmospheres, and by ordinary glass.

After a variable latent period irradiation is followed by some degree of erythema, and after repeated exposures pigmentation ensues. This is protective in function as it holds back the harmful heating rays. The general effects are perhaps the most important. The chief of these are an increase in the defensive powers of the body, and correction of disordered states of mineral metabolism, such as that found in rickets. This is a disease characterized by defective formation of bony tissue. It is very liable to develop in young animals fed on diets badly balanced in regard to calcium and phosphorus. Experiments on pigs have shown that animals fed on such diets are less liable to develop rickets if allowed access to sunshine. Other experiments showed that the absorption of these elements was improved by artificial irradiation with ultra-violet light if the pigs were fed on a ration that was not ideally balanced. The rays, however, had no significant effect on the assimilation of calcium and phosphorus, in the case of pigs fed on rations ideally balanced in regard to these elements.

Lactating animals in full milk habitually lose more calcium in urine, fæces, and milk than they absorb. Experiments have shown that irradiation with ultra-violet rays diminishes this loss by improving absorption of calcium. Repeated pregnancies and lactations, especially in heavy milking animals, induce prolonged losses of calcium from the body, of which sterility and abortion are not uncommon consequences.

The curative value of outdoor life in all forms of tuberculosis has been well recognized for generations, but only in 1893 was it realized that the ultra-violet rays of the sunlight were the chief factors in promoting healing of the tuberculosis lesions. Since that time the success obtained by direct sunlight and by irradiation with artificial ultra-violet light has been so extraordinary that such measures appear to be gradually replacing other forms of treatment.

Meteorological Factors affecting Fertility in Sheep (J. E. Nichols).—During the last century, small modifications in the domestic sheep have been encouraged, until the great number of modern distinct breeds has resulted and the sheep has been introduced into new districts. The chief factor in the distribution of breeds must be their ability to live, and the fertility of a flock or a breed in new habitats must be considered. The critical periods in the life of sheep are the rutting or tupping season, the lambing season, the first few weeks of the post-natal existence of the lambs, and, to a lesser extent, the gestation period. The lambing season is a reflection of the tupping season, and there is considerable evidence that the onset of the breeding season occurs with a falling temperature.

Records were taken of a Cheviot and a Blackface flock, kept at the same farm for the period 1911-1924 inclusive. Each flock was pure bred and had been kept under the same conditions of pasturage, altitude, and management for the entire period. The records gave the number of ewes in the flock alive at the end of lambing time, the total number of lambs alive on May 28 each year, the number of lambs alive at castrating time three to four weeks later, and a figure for "eild" or barren ewes. The meteorological records kept were, mean monthly temperature, mean daily range of temperature, number of rainy days, and rain in inches.

The measure of fertility used was that of the number of live lambs at the end of the lambing season in proportion to the number of ewes then alive, the proportion being expressed as a percentage and termed "lambs percentage."

No definite conclusions can be drawn from the data as to the influence of meteorological conditions at the time of service on the ultimate lambs percentage, but in the case of conditions at lambing time definite associations do appear. While the mean daily temperature and the rainfall in inches during lambing time have no correlation with lambs percentage in either flock, the mean daily range of temperature and the number of rainy days do show significant correlation. High daily range of temperature is associated in both flocks with high lambs percentage. The number of rainy days at lambing time is negatively correlated with lambs percentage in both flocks and positively correlated with barrenness.

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TAR-OIL WASH TRIALS IN THE WEST MIDLANDS, 1926-27

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DURING the winters of 1924-25 and 1925-26 trials were carried out in Shropshire, Staffordshire and Warwickshire with various brands of proprietary tar-distillate washes. In 1924-25, five brands were used, and of these Carbokrimp and Mortegg proved easily the best; the other three washes were withdrawn from the market in the following year. In 1925-26, more extensive trials were carried out, using Carbokrimp and Mortegg only, in order to try the effect of different strengths of these washes. The results of these trials* led to definite conclusions regarding the strength at which the washes can safely be used and the approximate latest dates at which they may be safely applied.

Since then many new washes of similar composition have been put on the market, and, during the winter of 1926-27, two brands not previously tested (Tarolite and Battle's Wash) were introduced into the trials, Mortegg being used as the standard with which they were compared.

Research, by Messrs. Tattersfield and Gimingham at Rothamsted Experimental Station, has shown that di-nitro-cresol and its sodium salt possess an egg-killing power very similar to that exhibited by Tar Oil Washes. The writer was asked to include in the trials two washes of this nature which are here called Wash A and Wash B.†

Wash A consists of di-nitro-cresol and a solvent, Wash B is the sodium salt of di-nitro-cresol in water, plus soft soap. The former leaves a yellow and the latter a reddish stain on the hands and clothes, which washes off with little trouble. On the other hand, both these washes mix very readily with water; their covering power seems slightly better than that of the best tar-distillate washes, and they also possess an advantage in not clogging any part of the spraying machinery.

Strength of Washes (*Apples*).—The tar-distillate washes were all used at 10 per cent. concentration, and the di-nitro-cresol washes were diluted to give a concentration equivalent to 0·2 per cent. of di-nitro-cresol.

Plums and Damsons.—The tar-distillate washes were all used at 6 per cent., and the di-nitro-cresol washes at the same strength as on apples.

* *See* this JOURNAL, November, 1926, p. 753.

† It is understood that a full account of all the field trials conducted with di-nitro-cresol washes during the past year will be published later.

Lay-out of Experiment.—At each centre, 40 trees were used, 30 of which were sprayed, the remaining 10 being kept as controls. Thus, using five different washes, six trees were sprayed with each wash. Where possible, the sprayed and control trees were arranged in chequer-board fashion to obviate, as far as possible, errors due to the uneven distribution of the insects concerned.

TABLE I.

Orchard	Key letter	Fruit	Date of spraying	Date of examination
Co-operative Wholesale Society Estate, Roden, Salop.	A	Apples (Bismarck)	February 8	May 18
		Plums (Victorias)	January 31	May 20
		Damsons	Dec. 19, 1926	May 20
Mr. Venables, Moreton, Staffs.	B	Damsons	Dec. 20, 1926	May 5
Mr. Percival, Rodbaston, Staffs.	C	Apples (mixed)	February 9	May 5
		Plums (mixed)	January 20	May 5
Mr. Blackwell Sims, Bickmarsh Hall, Bidford-on-Avon, Warwick.	D	Plums (Czar)	January 19	May 9
		Apples (Worcester)	January 19	May 9

Estimation of Results.—In estimating the effect of the washes, each tree was taken in turn, and given its mark. The figure given in Tables II and III represents the average value of the marking of all six trees sprayed with each wash. The labels on the trees carried a code letter or number, and at the time of marking the actual brand of wash referred to by any particular label was not known.

The actual system of marking is indicated by notes given below Tables II and III.

DISCUSSION OF RESULTS

Apples (*Aphides and Psylla*).—In none of the orchards under experiment were the control trees very heavily infested. At A, none were present; and there were very few at C, and at D. Consequently the differentiation between one wash and another was not well marked. It would seem, however, that Washes A and B did not exercise a complete control on these insects, whereas the three tar-distillate washes gave trees which were entirely free.

TABLE II.—APPLES.

Orchard	Pest	Control	Mortegg	Tarolite	Battle's	Wash A	Wash B
A	Winter Moth Caterpillar	12	6	11·6	9·3	10	14
	Capsid	17·4	9·5	18	13	15·5	18
C	Winter Moth Caterpillar	15	8	6·2	6·6	11	15
	A. pomi ..	1	—	—	—	Tr	Tr
	A. roseus..	1	—	—	—	—	Tr
	Psylla ..	1	—	—	—	Tr	Tr
D	Winter Moth Caterpillar	7	2	2	2	2	3
	Capsid ..	24	2	1	5	7	10
	Psylla ..	3	—	—	—	2	3

SYSTEM OF MARKING.

Winter Moth Caterpillar.—The figure given is an estimate of the actual number of caterpillars per tree, and represents an average obtained from counting every individual tree.

Psylla and Aphis.—A figure of 10 is given where the attack is very heavy, and this figure falls to 1 where the attack is slight.

Tr=trace, indication that a few scattered individuals were present.

Capsid.—The figure given represents the percentage number of leaf trusses showing characteristic markings. As with Caterpillars, the figure is the average arrived at after estimating each tree.

Winter Moth Caterpillars.—It had been found, in previous trials, that the best tar-distillate washes did not appear to give a complete control of winter moth caterpillars, and, at best, only effected a partial reduction in numbers. On the other hand, it has been found that under laboratory conditions, Washes A and B will give almost 100 per cent. kill on winter moth eggs. In no case have results of this kind been obtained in the field, and one is led to seek for a reason. There may be a number of factors which account for the discrepancy.

In the first place, there is the possibility of caterpillars getting on to the trees, where they have not been hatched from eggs laid there. Some larvæ are known to be carried by the wind for considerable distances, supported either by so-called "bladder" hairs, by which they are covered, or by threads of silk, in the same way as young spiders. They may possibly arrive on the trees from outside sources in this way.

Again, although it is easy to find eggs of aphides and apple sucker, since they are laid in more or less exposed situations on the bark, it is by no means so simple to find large numbers of winter moth eggs. The female moths may lay from 100-200 eggs, and it is by no means uncommon for 50 moths to be taken on one grease band. A careful search should reveal the presence of numbers of eggs, therefore, and yet it is very difficult to find them in any great quantity. The female moth may take trouble to conceal some of her eggs in crevices and under loose bark, in which position many would escape contact with a wash, applied under field conditions, and would hatch normally.

Finally, it is by no means certain that all the winter moth eggs are laid by the time spraying is done. The March moth probably escapes in any case, but the ordinary winter moth (*C. brumata*) appears to ascend the trees over a long period, and it is quite conceivable that the caterpillars which appear to survive spraying really emerge from eggs laid after spraying is completed. Whatever the explanation, it is certain that no tar-distillate wash, used in these trials, can be relied upon regularly to give a tree clear of caterpillar.

In Orchard A, Mortegg appeared to give the best result, but in orchards C and D the other two washes, Battle's and Tarolite, came out with rather better figures. The differences, however, are small, and one cannot conclude that any of the three proprietary washes was superior to the others. The best sprayed trees, however, always had about half the number of caterpillars that were to be found on the controls. Washes A and B are again slightly less effective than the tar-distillate washes, with Wash B rather inferior to Wash A. Indeed, it may be said that, except in Orchard D, neither of these two exercised more than a very slight control.

Capsid Bug.—The results of previous trials in an orchard in South Warwickshire indicated a good control of capsid bug by 10 per cent. strength of Mortegg and Carbokrimp. Observers in other parts of the country, however, have found very little effect on this insect, and conclude that tar-distillate washes cannot be relied upon to control it. The results of trials this year seem to confirm their conclusions, for, in Orchard A, there was little difference to be seen between sprayed and unsprayed trees, except where Mortegg had been used. Examination of the control trees, however, indicated an extremely uneven distribution of the insect, and this was so pronounced that the chequer-board arrangement of the trees had not altogether

overcome it. Ten control trees gave figures which varied from 0 to 75 per cent. Capsid bug attack, varied according to their location, and a further extensive examination of the orchard, showed that the insect was very much more prevalent on one

TABLE III.—DAMSONS.

Orchard	Pest	Control	Mortegg	Tarolite	Battle's	Wash A	Wash B
A	Leaf-Curling Aphis	13 per cent.	Nil	Nil	Nil	Nil	Nil
	Winter Moth Caterpillar		No estimation possible.				
B	Leaf-Curling Aphis	25 per cent.	1 per cent.	1 per cent.	2 per cent.	1 per cent.	2 per cent.
	Winter Moth Caterpillar		No estimation possible.				
A	Leaf-Curling Aphis	2 per cent.	All trees	PLUMS showed less than 1 per cent. leaves curled.			
	Winter Moth Caterpillar		No estimation possible.				
D	Leaf-Curling Aphis	30 per cent.	All less than 1 per cent. showing curling of the leaves				
	Winter Moth Caterpillar	10	No appreciable reduction in numbers.				
C	Leaf-Curling Aphis	Nil	Nil	Nil	Nil	Nil	Nil
	Winter Moth Caterpillar	30	15	20	15	10	10

SYSTEM OF MARKING.

Leaf-Curling Aphis.—The figure is again an average one, representing the percentage of curled leaves on the tree.

Winter Moth Caterpillar.—The figure given is an estimate of the actual number of caterpillars per tree, and represents an average obtained from counting every individual tree.

side than on the other. The same wash in one situation appeared to give a clean tree, whilst 20 yards away it had no apparent effect. The rest of the orchard had been sprayed with Mortegg, and the same effect could be seen.

In Orchard D, in South Warwickshire, within a few miles of the orchard where last year's experiments were conducted, all washes gave better figures than the controls, but here, as last year, the trees were arranged in rows and not chequered. The control exercised is probably, therefore, only an apparent one, due to the very uneven distribution of the insect, and, since tar-distillate washes have been used on a larger scale in commercial orchards, evidence has accumulated pointing to the fact that very little control of capsid bug is to be expected.

Plums and Damsons (*Leaf-Curling Plum Aphis*).—All washes, including A and B, seem to control this aphis quite effectively. In no case was the amount of curling appreciable on sprayed trees, and, where it did occur, appearances indicated that a small portion of the tree had not been covered by the wash.

Winter Moth Caterpillars.—The position with regard to plums and damsons is precisely the same as with apples. Since spraying is usually carried out earlier on plums and damsons, one would expect to obtain rather less control, and this seems to be the case. Large trees are very difficult to estimate in this respect, but there was no reason to think, from a careful observation, that anything more than a partial control had been exercised.

Bud Scorch.—In no case was any damage caused to the blossom buds in these experiments. All the sprayed trees carried bloom quite equal to the controls, but the subsequent crop was severely thinned by late frosts.

Acknowledgment is made to the County Horticultural Staffs for their assistance in carrying out these trials, and to the proprietors of the orchards for providing the facilities.

Conclusions.—1. Since the number of aphides and apple sucker were small on the control trees, the relative merits of the washes were difficult to determine.

2. Mortegg, Battle's Winter Wash and Tarolite all appear to control these insects quite effectively. Washes A and B were not quite so satisfactory on apples, but controlled leaf-curling plum aphis well.

3. None of the washes gave more than a partial control of winter moth caterpillars.

4. Results obtained on the control of capsid bug may be very deceptive. The distribution of this insect, even over a

small area, may be very irregular, and unless precautions are taken to allow for this, one may easily arrive at wrong conclusions as to the value of any particular wash.

5. The covering power of di-nitro-cresol washes was equal to that of any of the tar-distillate washes. Di-nitro-cresol washes leave marked stains on the clothes and skin, but do not leave a residue which clogs the spraying machinery.

6. The trees were in no way harmed by any wash, and the strengths used may be regarded as safe when applied on Plums and Damsons before the end of January, and on Apples before the end of February.

NOTE.—Permission has been given by the respective manufacturers for the publication of the names of the proprietary washes in these results.

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IMPERIAL ECONOMIC COMMITTEE'S REPORT ON THE MARKETING OF EGGS AND POULTRY, AND OF HONEY

THE Imperial Economic Committee was appointed in March, 1925, by the Governments of the United Kingdom, the Dominions, India, the Colonies and Protectorates, to consider the possibility of improving the methods of preparing for market, and marketing, within the United Kingdom, the food products of the overseas parts of the Empire, the object being to increase the consumption of such products in the United Kingdom in preference to imports from foreign countries, and to promote the interests both of producers and consumers. In each of the Reports issued as the result of the Committee's investigations—of which there are now seven—the Committee particularly stress the need for standardization and grading if produce is to be handled rapidly and economically.

The inquiry of the Committee into the marketing of eggs and poultry and of honey has lately been completed, and the results and findings are issued in the form of two Reports, published in one volume.*

Marketing of Eggs and Poultry.—In the Report dealing with eggs and poultry the Committee acknowledge the assistance they have derived from the Report on Egg Marketing and the Report on the Marketing of Poultry, which were issued by the Ministry of Agriculture and Fisheries in its Economic

* Report of the Imperial Economic Committee on Marketing and Preparing for Market of Foodstuffs Produced within the Empire: Sixth Report: *Poultry and Eggs*; and Seventh Report: *Honey*. H.M. Stationery Office, 1s. net. [Cmd. 3015.]

Series in 1926† ; the study of these two Reports is commended to all connected with the industry.

The Committee refer to the efforts which certain Dominions and foreign countries have made to ensure a high standard of quality and of uniformity in the eggs exported. Particulars are also given of the legislative action taken in certain cases. Although there are notable exceptions, much of our home produce reaches the market ungraded and poorly packed, and there is a pressing need for the acceptance and observance of generally recognized standards. The Committee recall that in the Report on Egg Marketing (Economic Series No. 10), it is recommended that home-produced eggs, especially those intended for the wholesale market, should be classified and graded to recognized standards and packed in standard packages ; definite standards are put forward for consideration. The Committee have been assured by representatives of the National Farmers' Union and of the National Poultry Council that the general correctness of the conclusions reached in that Report is accepted. It may, therefore, be taken as recognized, fairly widely, that standardization of poultry products is an inevitable reform to which the poultry industry in Great Britain must resort sooner or later. In this connexion the Committee make the important statement that consideration should ultimately be given to the adoption of uniform standards throughout the Empire.

Attention is also called to the suggestion, put forward by the Ministry, that eggs produced in England and Wales should be marketed under a national brand or trade mark, and that, in the absence of mandatory legislation, there should be an organization to safeguard the reputation of the mark and to ensure continuous supply. These proposals, in the view of the Committee, are a logical consequence of the adoption of standardization, and cannot fail to be of substantial value. Whatever scheme of reform is adopted, the Committee stress the importance of securing the support of the majority of producers and of the more important dealers and retailers.

On the question of the exercise by the consumer of a preference for Empire products, the Committee believe that such preference would operate in the first instance in favour of the home producer, but obviously it could only become

† Economic Series, Nos. 10 and 11. H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 6d. each net, post free 9½d. and 9d. each, respectively.

effective if there were means of identifying the origin of the produce, and this necessitates adequate marking. The Standing Committee, appointed under the Merchandise Marks Act, 1926, have, however, recently advised against such marking of eggs until, *inter alia*, improvement has been effected in the preparation for market and in the marketing of home-produced eggs. The Imperial Economic Committee interpret this decision as merely postponing the issue of such an Order until certain conditions are fulfilled, and they express the hope that it may be possible, within a relatively short period, to ask the Standing Committee to review the position in the light of any fresh evidence that may be produced, and to take into account the effect of a Marking Order on supplies from the Empire, both home and overseas.

In dealing with the marketing of poultry, the Committee point out that several countries have established a good reputation for the quality and reliability of the poultry they send to the British market. The birds are well-finished, uniformly-sorted, carefully-packed, and consequently easily inspected for trade purposes. This is the result of production, throughout considerable areas, of fowls of one general type, which are "finished" to similar standards, and then sorted and packed on a uniform plan. The Committee emphasize the important part played by establishments that specialize in commercial fattening and finishing, and they refer, in this connexion, to the fact that the Ministry of Agriculture and Fisheries has already, in the Poultry Marketing Report (Economic Series No. 11), drawn attention to the rough and unfinished condition of much of the home-produced poultry sent to market, and that the Ministry, after consultation with producers and traders, has drawn up definite standards for finishing, grading, and packing which have been the subject of public demonstration. The Committee express the view that a condition precedent to the general application of commercial finishing stations must be the establishment of greater uniformity in type of birds throughout considerable areas.

The Report is comprehensive, dealing as it does, *inter alia*, with such questions as production, imports, consumption, price variations, packing, grading, and preservation. The last chapter summarizes the main conclusions of the Committee, and, in an Appendix, a note is included on State-aided efforts in some parts of the Empire to improve poultry stocks and the methods of poultry keeping. In other Appendices are given tables showing the imports of eggs

over a number of years, diagrams showing variations in prices of eggs, and statistical data relating to the trade in poultry.

Marketing of Honey.—The Report on the Marketing of Honey stresses the importance of bee-keeping to agriculture; its economic value to the fruit and general farmer is not restricted to the value of the honey produced, but is reflected in more copious crops of fruit and pasture. An increase in the demand for Empire honey, therefore, does not merely mean an increased demand for a pleasant food, but also increased fruit crops and better pastures.

Production in the United Kingdom is steadily recovering from the severe set-back received a few years ago through the general loss of bees from widespread disease; all home-produced honey finds a ready sale without appearing on the wholesale markets which are supplied by imports. Nearly half of these imports is produced within the Empire, notably Jamaica, New Zealand, and Canada; of foreign countries, the U.S.A., the West Indies, and Chile are the chief suppliers. Strict control has established for New Zealand honey a high reputation for quality and reliability; the control consists chiefly in centralized marketing, with its incidental standardization of grades and of containers, and the prohibition of the export of any honey below a specified standard of quality. Other Dominions have adopted similar methods of control, or are about to do so. Once again, the need is emphasized for defining and maintaining standards of quality in order to enable full advantage to be taken of the methods and needs of modern commercial practice.

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THE COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-sixth meeting of the Council of Agriculture for England was held at the Middlesex Guildhall, Westminster, on January 26, Mr. W. R. SMITH in the Chair.

Electricity in Rural Areas.—Mr. DENTON WOODHEAD, the Vice-Chairman of the Standing Committee of the Council, moved the adoption of the Standing Committee's Interim Report on Electricity in Rural Areas. Its purport was that the Conference called by the Electricity Commissioners in November last had appointed two sub-committees to report on certain technical and administrative questions. It was expected that their reports would be received in March next, and the Standing Committee considered that it would be better that full consideration of the matter should be delayed until the reports were to hand. Mr. WEARMOUTH (Durham) supported the Report. He thought it might be possible to get electricity applied to agriculture first of all in those mining areas in which sub-stations already existed. Sir DOUGLAS NEWTON, M.P. (Cambs.), referred to the high standard which was insisted on in the erection of transmission lines in this country, requiring an outlay at present of from £600 to £800 a mile. Before electricity for country districts was practicable, that cost would have to be reduced to something like £150 to £250 a mile, the cost per unit being brought down to 1d. or 1½d. The Report was adopted by the Council.

Fluid Milk Marketing.—Mr. A. W. ASHBY, on behalf of the Standing Committee, moved the adoption of their Report on the Ministry's Report on Fluid Milk Marketing (Economic Series, No. 16). It recommended the volume to members of the Council and to the agricultural community generally, as it dealt very thoroughly with the production, wholesale sale, transport, and retail sale of milk in England and Wales, giving special attention to a definition of the areas of milk production and consumption, the annual and seasonal variations in production, and the movement of milk towards the centres of consumption. The questions of the grading of milk, and the demand and prices for the grades, were also dealt with as matters of special interest to milk producers. The great difference between the average daily consumption of milk in this country (⅓ pint) and that in other countries on the Continent (from 1 to 2 pints) was noted, and the need stressed for greater publicity for milk as a good cheap food both for

young and old. The Report quoted the Ministry's Report as follows :—

> The road to increased demand lies through emphasis upon quality and guarantees of safety, and specially in raising the status and standing of ordinary milk. . . . Given this basis of confidence, methods of publicity should be widely employed, and in view of the great public interest involved in securing adequate supplies of good milk for all young people, the support of public authorities should be actively accorded.

Mr. Ashby said that the milk industry was the one branch which British farmers could expand very rapidly. The demand for milk was increasing, and the Standing Committee's Report suggested that the Public Health Authorities should take a greater share in publicity for increased consumption. Mr. HAMILTON (Lancs.) considered that it was not fair to the industry for Medical Officers to recommend the use of dried milk in preference to liquid milk. Mr. WOODHEAD called attention to the fact that in the North of England an experiment was being made with slot machines for supplying milk in populous areas. Mr. GIBBONS (Glos.) called attention to the great difficulty in rural areas for many people to get milk ; it would certainly raise the consumption over the country if they could be enabled to do so. The Report was adopted.

Better Marketing.—The Right Hon. Sir FRANCIS ACLAND Bart., Chairman of the Standing Committee of the Council, moved the adoption of the Standing Committee's Report on the Improvement of Marketing of Agricultural Produce. He pointed out that the Standing Committee had worked hard on this Report since the last meeting of the Council in October, when the Council commissioned them to prepare it. He, personally, through a chapter of accidents, had not been able to be present except at the first and last of the meetings. He considered that the Report, as presented, gave, in a useful form, a summary of the present position as regards all the main commodities, together with a reference to the sources of information. The Ministry's orange books were very excellent and interesting and should be more widely read. Considering the marketing of milk, Sir Francis suggested that the milk distributing combine might consider making a freewill offering to the industry in the form of a contribution to the campaign. At present, the retailer got quite a considerable margin for the services rendered. It was possible that the retail price might be reduced, and publicity directed to the general improvement in the quality of milk. Both would then lead to increased consumption, which would tend to reduce the present

bugbear of surplus milk. On the general question, he was not sure that the National Farmers' Union had been on sound lines in advising their branches to go into the question of improvement of marketing as a local matter and to get into touch with the agricultural organizations in their counties. Agriculture as a science was one matter, and agriculture as a business was another, and advisers who were best qualified to help on the scientific side might not be sound on the business side. The present Report endeavoured to show the way forward. It was too much to expect that individual farmers would, at the present time, sit down and plan better business organization. It would have to be a national movement, and the Government would have to help.

Mr. WOODHEAD referred to the circumstances under which the Report had been produced. The farmer, as producer, ran all the risks of production, and the middleman, as a rule, came in and took the bulk of the profits. He would say to the industry, "Whatever anybody does for you, the success or otherwise of your undertaking will depend absolutely upon what you do for yourself." It was no use trusting to Governments or politicians. Running through the whole of the Report would be found the suggestion that organizations should be set up to deal with the combined sale of farm produce. Farmers would have to make contracts with these organizations and stick to them. It would not do for them to go afterwards to someone who offered 1d. a lb. more with a view—as a rule—to breaking the co-operation. Another point was that, in combining produce, the man who produced the best goods should have the best price. Then there was the question of packing and grading. These should be done under expert direction. As regards transport, railway companies should be approached reasonably and logically as suggested in the Report. The industry had a right to cheap transport if it was to produce cheap food. There was no possibility that the agricultural worker could be paid less than at the present time, so that cheapness could not be looked for from a reduction of wages.

Mr. CHARLES ROBERTS (Cumbs.) expressed gratitude to the Standing Committee for having brought into one short Report a general conspectus of the whole subject as set forth in the Ministry's Economic Series. His criticism was that the Report did not exactly bring to a point what the farmer should do and what the Government should do. He hoped the Minister would to-day tell the Council what the Government was

prepared to do, and what the farmer was expected to do. He was not sure whether the suggestion was for farmers to deal piecemeal with the question, or otherwise. He hoped it was not piecemeal. He wanted the Government to continue its propaganda by way of public reports and marketing demonstrations, to define, by statute, grades and standards for different classes of produce, and to supply more capital where capital was needed.

Mr. WALTER GUINNESS, *Minister of Agriculture*, said he welcomed the Standing Committee's most valuable Report. He had not intended to discuss it this morning, being rather anxious to hear the views of the Council upon it. Mr. Roberts, however, had asked for the Government's proposals, and he would say that, in the marketing of each commodity, Government action fell into three stages. First, a stage of investigation and demonstration; then a stage of consultation with the industry; and lastly, the enactment of statutory powers to enable better organization within the industry. One commodity only had reached the last stage, *viz.*, eggs. Fruit and pigs had reached the second stage. The Minister discussed the question of better grading and sale of eggs, and said that he hoped the scheme which had been produced by the Poultry Advisory Committee would be adopted by the industry within a week or two.

A Bill would then be introduced to enable the Ministry to define the grades under which eggs coming under a voluntary scheme could be sold, probably with a National Mark. Preserved eggs would have to be identified from fresh eggs, and the marking of them could only be imposed in combination with an Order for the marking of imported eggs. The Bill for defining grades, therefore, clearly would not be able to come into effect until an Order had been made for the marking of imported eggs. The Government had undertaken to find time to pass the necessary legislation this Session. The Government might, in the Bill, take power to make regulations for the grading of other forms of agricultural produce.

Mr. WEARMOUTH considered that, under the Short Term Credits Scheme, Agricultural Committees should be enabled to give approved farmers credit on their stocks of wheat at harvest time and before it is sold. Mr. R. G. PATTERSON (Staffs.) said that no problem was of more vital importance to the farmer to-day than that of proper marketing. It had been stated in the Press that meat could be purchased in London at 8d. and 8½d. a lb., and the choice parts of it sold

at prices ranging up to 2s. 8d. If a butcher sold half a carcass at 2s. a lb. he could afford to give the other half away. The farmer was at the mercy of the middleman on the one side and the manufacturer and merchant on the other. The Report, in his view, indicated a need for two things. First, that farmers should endeavour to gain control of the means of distribution; that was a very large and difficult question, and probably impossible to-day. The other was a kind of Government control in the interests of the industry. It was for farmers to make up their minds whether a remedy was to be found in combination and co-operation coupled with assistance from the Government, or whether Government control would be quicker and more effective.

Mr. W. B. TAYLOR (Norfolk) said he had somewhat hastily scanned the 14 pages of the Report, and was wondering what the average working farmer and smallholder would think of it as a practical means of solving the problems which faced him to-day. There did not appear to him to be one practical proposal that was courageously put forward by the Report for the benefit of the industry. He had heard politicians of an irresponsible character talking about pooling the goods of the nation, and, when a practical Committee brought proposals of this kind before the Council, he would suggest that Mr. Patterson's proposal for control was of a far more practical character. It was clear that the industry was unable by itself to weather the storm. Alderman DAVIS (Durham) said he was somewhat nervous of the paragraph which suggested Government assistance in warehousing the wheat crop. He also thought the pooling of wheat idea a very dangerous one in connexion with grain produced in this country.

Mr. GEORGE EDWARDS thanked the Standing Committee for the serious consideration given to this important subject. He would like to have seen more practical suggestions, especially in relation to the marketing of wheat. He thought that, sooner or later, the Government would have to deal with the subject of marketing wheat and other cereals. The Committee might have made practical suggestions for the stabilization of prices. The actual assistance required from the Government to improve marketing should be definitely set forth. The suggestions made in the Report would involve a vast organization and a great deal of capital. If farmers would use their great organization, the National Farmers' Union, to initiate this new marketing process, they would be performing a great service to the industry. He did not care who did the work,

provided the industry was helped to put its goods on the market, so that there was not so great a gulf between the producer and consumer. What was to be done, should be done speedily. The smallholder had been hit very hard, and attempts were being made to bring the agricultural labourer's wage down much lower, to a starvation wage.

At this point, the CHAIRMAN said he would like the Council to keep in mind, in discussing the Report, that it was just three months since the resolution was passed referring the subject for consideration to the Standing Committee. It had reported on 11 subjects, and it was impossible to expect complete and definite recommendations to be made on any one of them, having regard to the particular circumstances. If the Council now wished the matters pursued further, if they wanted any particular subject examined in detail, with a view to concrete proposals being made, that could only be done by means of a body appointed for the purpose which would have proper time to go into the problems.

Mr. F. T. K. CROSS (Berks.) suggested that the Report should be treated as an Interim Report, to be amplified after a fuller examination of some of the subjects. More definite recommendations could then be placed before the Council. He suggested that co-operation and the question of what should be the unit of management for marketing might be further considered and reported upon. Mr. CHRISTOPHER TURNOR said that the Report was a valuable contribution on the present agricultural situation. As regards the control of prices suggested by Mr. Patterson, it was important to know whether the control was to be imposed by the Government or would be the result of organization within the industry. He thought the latter the better form, but in these times the Government would probably have to do more than would be welcome in ordinary times. Agriculturists should keep in mind control, not only of prices, but of the industry, by the industry itself. The Report placed the Council in a position to inquire in each county what could be done. It would be extremely unwise to attempt to create organized marketing over a wide range of commodities at once. In the last 20 or 30 years failure to bring about sound development had ensued through trying to do too much at headquarters, leaving local initiative out. It was necessary now to get down to localities.

Mr. GEORGE DALLAS, speaking as a member of the Standing Committee, welcomed the suggestions by previous speakers.

Some of the members of the Committee had felt strongly that their investigations should be continued. In his judgment, agriculture was on the eve of one of the greatest changes for generations. It was becoming plain that the British farmer would have to standardize his goods; he was confident that the farmer would readily respond. Major S. V. HOTCHKIN (Lindsey) also welcomed the Report, which, in his view, contained practical recommendations on sound lines. They hinged on co-operation by farmers in the business of marketing their produce. All big industries were organized nowadays. The longer the period of depression the more difficult it would be to organize, because the farmer would get shorter and shorter of capital, and would be forced more into the hands of the local corn merchants, dealers, and tradesmen. If they went to these men for help in bad times, they would stick to them afterwards. Some form of temporary control seemed necessary at once to save the farmer who could not go on producing food and paying labourers at a loss. Mr. R. C. GREY (Hunts.) said he had been much struck by Mr. Patterson's suggestion that the farmer should either get in close touch with the consumer, or have some form of Government control. He did not understand why the consumer should be content to pay the price he did for meat, knowing the wholesale prices. He suggested that since the War the industry had been off economic lines. Mr. OWEN WEBB (Cambs.) said he agreed with Mr. George Edwards and Mr. Dallas that the Report should deal more closely with wheat. The policy of the plough was the only policy that could save agriculture.

Mr. A. W. ASHBY said that, on the whole, the Standing Committee might, he thought, be satisfied with the work they had done. The Report contained suggestions and recommendations which, as a composite body, it could wholly and fully agree to put before the Council. Those who led farming opinion could now go off to their local areas with the Report as one that was adopted by the Council. He referred then especially to the question of grades and standards for eggs, hoping that legislation would speedily be possible. He thought, however, that the machinery at present suggested might result in riveting the present merchanting system of eggs on the backs of egg-producers. That system should rather be developed and extended as the Standing Committee's Report suggested. There should be a string of producers' collecting depots working under a central system, running such pooling arrangements in their own areas as might be necessary, and

so organizing supplies for the wholesale markets. The existing marketing system gave too little information to the farmer about what the ultimate consumers' markets wanted. Every farmer who was going to be concerned in a grading system would have to realize that its merits went back to the very foundation of his business. A very large part of his produce would have to get into the first grade, and it was there that the nation as a whole became concerned in the problem. The home industry had to recover the good-will of the woman who carried the basket. The danger at the moment was that farmers would put off practical action too long.

Sir FRANCIS ACLAND, in concluding the debate, said that the Standing Committee would certainly give careful consideration to the suggestions which had been made. It had already stated in the Report that it would go further into the question of the buying of wheat under national control. They would probably also consider the indication of the parts which the farmer and the State should play in working towards a proper marketing system. He would like every farmer to remember this simple story: "There were people living on two sides of a stream who wished to be more closely united. When the torrent was strong, they always said, 'We cannot build a bridge'; when the flood died down they always said, 'There is no need for a bridge.' They were rather a foolish people. Let us do better." Mr. WOODHEAD suggested that the Report might be printed and circulated among the Agricultural Committees of the counties. On the CHAIRMAN'S suggestion, the consideration of the printing of the Report was left to the Standing Committee. The Report was then put to the meeting and adopted.

Re-election of Standing Committee.—It was proposed by Sir GEORGE COURTHOPE, seconded by Mr. F. T. K. CROSS, and carried, that the Standing Committee be re-elected *en bloc*.

Milk Publicity.—Mr. DALLAS moved:—

> That this Council considers that, in view of the fact that the conditions of the production of milk in this country have so much improved in recent years, all possible steps should be taken to bring to the notice of the people of this country the food value of milk with the object of increasing its consumption. Such action would be not only in the interests of agriculturists but also of public health. The Council urges that the educational work in the schools and amongst the public which is now going forward in this matter should be developed to the very fullest extent.

He said that on this subject the Press of the country could do a great deal to help Agriculture. Some years ago people

were alarmed when Medical Officers of Health made damaging statements as to the quality and condition of the milk they had examined. These reports were rarely in evidence nowadays. He gave two instances in which the Medical Officers' reports had in a few years improved enormously. In 1927, in London, no tubercle at all had been found in milk samples, although there was 25 per cent. in 1921 and 2·5 per cent. in 1926. In Godalming, the Medical Officer said that, of 26 samples taken in 1926, 12 were up to the standard required by the Ministry of Health for certified milk, and in no case was tubercle discovered. It could not be too strongly emphasized how bad it must be for children to be brought up on tinned, condensed, skimmed milk. He then referred to a scheme set up in the schools, very largely by the aid of retailers, whereby children were sold bottles of milk, at a very low cost, for consumption in school hours. This scheme should be extended, to the great improvement of the health of the people. Mr. HAMILTON seconded the motion.

The MINISTER said he would like to endorse what Mr. Dallas had said as to the need of bringing home to the consumer the very considerable improvement which had taken place in the milk supply. The Government were alive to the need for publicity concerning the improved position, and the Empire Marketing Board were in negotiation with the industry with a view to launching a great campaign to encourage people to drink milk. The Board expected to get support from the industry, and were ready to spend within the next two years a total of £100,000 on the work. The Ministry most strongly welcomed Mr. Dallas's resolution, and would continue to do all it could by influencing those who control public education to see that children are taught in the schools the value of milk as an article of diet. Mr. GEORGE NICHOLLS (Soke of Peterborough) put in a plea for the small cow-owners, some of whom were having to dispose of their cows as they were unable to meet the regulations under the Milk and Dairies Order. The villages, in consequence, were being forced to take the condensed skimmed milk. Mr. C. B. FISHER (Northants) also spoke in support of the resolution, though he said he would like to add words referring to the inferiority of tinned, skimmed milk. He gave particulars of an analysis of this article which showed it to be very much over-priced. He hoped that the Ministry of Health would have information collected from schools where milk is being given, so that results of improvement in physique could be recorded and appreciated. He

would like to emphasize the resolution he brought forward at the last meeting of the Council on the subject of the alteration of the Food Council. It should have a fairer representation of producers and consumers, so that questions such as the retail price of fresh milk and tinned, condensed milk could be properly gone into.

Sir DOUGLAS NEWTON said that the matter divided itself under two heads: one, propaganda, and the other, salesmanship. If the officers of the Ministry of Health and the Medical Officers of Health could agree that good milk was now being produced it would be a considerable benefit. As regards salesmanship, a start might be made in connexion with the supply of milk at the schools. Capt. E. T. MORRIS (Herts.) gave figures of imports of machine-skimmed, condensed milk. He agreed with Sir Douglas Newton that there should be more co-operation between the Ministries of Health and Agriculture. We were spending large sums on the health of children, and it was directly against the public interest that these large supplies of machine-skimmed, condensed milk came into the country. Mr. WM. MCCRACKEN (Cheshire) referred to the value of county milk competitions, the result of which was to show that propaganda on the value of milk could be carried forward without any doubt or fear. Mr. H. W. THOMAS (Hants.) suggested that the motion should be amended to ask for the prohibition of the importation of skimmed, condensed milk. The CHAIRMAN, however, referred to the fact that the resolution came from the Standing Committee, whose views on tinned, condensed milk were definitely stated in the Marketing Report which had been already adopted by the Council. The motion was put to the meeting and carried.

Report in this Journal.—The Rt. Hon. Lord STRACHIE (Somerset) moved:—

> That attention be called to the inaccurate report of the proceedings of the Council of Agriculture for England on October 20, 1927, which appears in the December issue of the JOURNAL OF THE MINISTRY OF AGRICULTURE.

He said that while a mis-statement of the Minister of Agriculture with reference to his (Lord Strachie's) attitude to the Agricultural Rates Bill, 1896, had been included in the report in question, his reply on that point had been omitted. He wished to make it clear that while he had voted for one particular amendment during the second reading debate on the Bill, he had afterwards supported the Bill, and had ever since been a strong supporter of the Act. The MINISTER replied that extraneous and party questions which had been

raised during the debate had been purposely omitted from the summary published in the JOURNAL. The CHAIRMAN decided that there could be no discussion on the subject, and proceeded to the next business.

Foot-and-Mouth Disease.—Col. Sir GEO. COURTHOPE, M.P. (East Sussex), moved :—

> That this Council, in view of the serious increase of Foot-and-Mouth Disease, and of the evidence that the virus reaches this country in active form in the bone marrow of imported chilled meat and bacon, urges the Minister of Agriculture to issue an Order prohibiting the distribution within the United Kingdom of any meat or bacon imported from countries where Foot-and-Mouth Disease exists, unless all bone has been removed from such meat or bacon prior to its importation.

He said that, in the second Progress Report of the Foot-and-Mouth Disease Research Committee, published about a year ago, there were statements that the Committee had discovered evidences of active virus of Foot-and-Mouth Disease in the bone marrow of meat, after very long periods, in spite of chilling, freezing, or salting. The incidents quoted in the Report were not actually in imported carcasses, but he understood that evidence had accumulated since to the effect that a large number of sides of bacon and carcasses did contain infected marrow. This made a sufficient case for him to ask the Minister to take administrative action to prevent the distribution through the country of infected bone with the meat. The value of imported beef and bacon from Foot-and-Mouth Disease countries was about 50 million sterling a year. Boned bacon and ham were already coming to the country from North America ; meat could be similarly treated. This country had quickly increased its production of pig products to meet the deficit through the embargo on the importation of pork and fresh pig carcasses from Europe. Nothing would benefit the arable farmers more to-day than that there should be a substantial increase in the animal population. Very little reliance could be placed upon inspection and notification of disease in the Argentine. The Minister had powers to take the action proposed, and he thought it provided him with a great opportunity to convince agriculturists that he had their interests truly at heart. Mr. JAMES DONALDSON (Oxford) seconded the motion. It was, he said, the duty of the Minister to use every means in his power to prevent the importation of Foot-and-Mouth Disease. To-day, Argentina was reeking with the disease, and it was clear that the meat was capable of bringing that disease to this country. The flocks and herds of the country should be protected.

The MINISTER, in reply, assured the Council that everything was being done that could be done at present to stop the introduction of infection. Two of the Veterinary Staff of the Ministry were now in South America, and the Government there had fully accepted the conditions of the Ministry which gave effective prevention of the introduction of infected animals into the slaughterhouses and freezing plants in Argentina. He thought that Sir George Courthope might have misunderstood the position somewhat. There was no evidence that infection had been brought in from the Argentine. The facts to which he had referred were in laboratory experiments showing that, theoretically, infection might be brought. He could not proceed to deal with the trade unless he had such definite evidence as he had in the case of the Dutch and Belgian pork carcasses 18 months ago. Bone marrow was a danger, but was nothing like the danger of the serum from the fresh, unfrozen carcasses the Ministry was now keeping out from Europe. If there were evidence that disease was brought in the bone of beef, he thought it would have to be dealt with by embargo, and not by boning. He was informed that it would be impossible to import boned, chilled meat from the Argentine.

Sir FRANCIS ACLAND gave an instance in which suspicion as to the cause of an outbreak in North Somerset was attached to bones on a rubbish dump, these having come from imported meat carcasses. The motion was then put to the meeting and carried.

Credit for Land Drainage.—Mr. G. G. REA, C.B.E. (Northumberland), moved :—

> That this Council respectfully urges His Majesty's Government when considering the conditions of their Long Term Credit Scheme to include provision for granting loans on favourable terms to individual landowners for the purpose of enabling them to drain, or re-drain, their agricultural land.

Mr. REA said that the question of land drainage was very serious at the present moment. The Government had taken steps to bring forward drainage measures and to encourage land drainage in many ways. Their schemes were, however, limited rather to large areas. He proposed that individual landowners should be helped with loans at favourable rates to enable them to drain, or in some cases re-drain, agricultural land. Many thousands of acres of arable land were at present derelict owing to lack of drainage. The rates of interest charged by the Lands Improvement Company were more than the landlord could pay. Rents could not be raised to recoup

expenditure. Much grazing land was also in a waterlogged condition, of very little value without drainage, producing liver fluke in sheep. The Government had a large amount of money deposited with it on which it paid a very low rate of interest, and he suggested that this might, through the instrumentality of legislation or other means, be used for the purpose. Mr. McCRACKEN seconded the resolution, and called attention to the large amount of old, inefficient land drainage work that existed in the country. It was in the national interest that steps of the kind proposed should be taken. Mr. GIBBONS thanked the Minister for one of the most useful Acts of Parliament ever passed, *viz.*, the recent Land Drainage Act. Heavy clay land which he owned and farmed was drained under the old system referred to by Mr. McCracken, which was still acting most efficiently. The MINISTER said that all the Government could do was to offer for field drainage the lowest rates that would be available in the way of capital for any improvements. He referred to the good work that was being done by the Lands Improvement Company in the direction indicated. The motion was put to the meeting and agreed.

Meat Prices.—Mr. C. B. FISHER, C.B.E. (Northants), moved:

> That an inquiry should be instituted into the cause of the difference in value of Scotch and English beef on the Smithfield Market, and that the Ministry of Agriculture and Fisheries be asked to appoint forthwith a Committee for that purpose consisting, amongst others, of one Grazier, one Feeder in yards or otherwise, and one Butcher.

Mr. Fisher said that English longsides of beef were quoted day after day at 48/-, and Scottish longsides up to 60/-, being in some cases a difference of about £10 a head. The least the Council should ask the Ministry in connexion with its Meat Report, which was under consideration, was to appoint a practical Committee to assist in it. He thought that breeding for milk had been carried too far. It was time that breeding for beef received greater encouragement, and the question of a smaller class of animal to meet the requirements of the trade had to be considered. Mr. J. O. ADAMS (Northants) seconded the motion. The MINISTER replied that he fully agreed as to the importance of the question. There did not, however, seem to be any object in setting up a special Committee at the present time, because two inquiries were going on. First, the inquiry, now nearing completion, in connexion with the preparation of a further number of the Economic Series, and the later inquiry by the Livestock Sub-

Committee and the National Farmers' Union. He did not think it would advance the solution of the problem to set up a third body as suggested. The resolution was put to the meeting and lost.

Relief for Eastern Counties.—Mr. CLEMENT SMITH (East Suffolk) moved :—

> That the attention of the Ministry of Agriculture and Fisheries be called to the critical position of Agriculture in the Eastern Counties—and the need for some immediate relief.

He said he wished to underline two words—"critical" and "immediate." He had never known the position of farming so difficult. Up to the last two years, he had been able to farm successfully to a certain extent, and to receive a moderate interest on his capital, but last year had altered the position. There was a debit balance on three farms of over £1,000, with no allowance for personal services or for interest on a capital of between £10,000 and £12,000. There were many cases worse than this, but he thought it might be regarded as a typical one in the Eastern Counties. Hundreds of farmers were simply hanging on a thread which could be cut at any time by bankers or traders. Land was going back, drainage, hedges, ditches, and buildings neglected, and landlords unable to help. Mr. W. B. TAYLOR seconded the resolution, saying that it might be made to apply generally over the country. One of the largest agricultural auctioneers in Norfolk had upwards of 80 farm sales for next Michaelmas already booked, and was unable to accept more. Barley, the staple cereal of Norfolk, had proved most disappointing through the failure of brewers to "buy British." They were making extraordinary profits with beer at aeroplane price and submarine quality. He would like to suggest that the Government should bring in a Pure Beer Bill and so secure a fair chance for British barley. The relief might be given by making the Education and Highway rates national charges, as they ought to be.

The MINISTER said that he thought the Eastern Counties were harder hit than any other part of the country. The Government fully realized the position and had extended a special measure of relief in the form of the Sugar Beet Subsidy. Norfolk and Suffolk were growing 87,000 acres of beet, which would mean at least £2,000,000 in subsidy. He would not repeat what was said by Mr. Lloyd George as to the impossibility of protection or subsidies, or what was subsequently said by Mr. Noel Buxton in the same sense. Other proposals had been considered by the Government, for instance, those concerning

malting barley, and he would ask Mr. Taylor to read the debates on previous Pure Beer Bills. It was pointed out by experts that, under a Pure Beer Bill, there would be grave danger of less British barley being used than now, because the brewer used sugar or foreign barley with a high content of starch for conversion into sugar, to enable him to counteract the excessive nitrogenous proportions in a good deal of lower-grade British barley. He had not the time now to develop the point. The particular debate he would refer to was in 1902. Other proposals had been brought forward which the Government had anxiously considered, but he did not hear that any of these partial remedies were within the Government control. They were examining the possibility of further lightening the farmer's burdens, either by basic grants from the Road Fund, or more relief of rates, or some method of that kind. He was unable, however, at the present stage to make any promise as to what it might be found possible to do.

After further discussion as to the desirability of making the resolution more general, the CHAIRMAN suggested that the word "specially" should be inserted after "Agriculture" in the second line. The mover and seconder accepted this, and the resolution was passed as follows:—

> That the attention of the Ministry of Agriculture and Fisheries be called to the critical position of Agriculture, specially in the Eastern Counties—and the need for some immediate relief.

The meeting of the Council then terminated.

APPENDIX

REPORT FROM STANDING COMMITTEE ON IMPROVEMENT OF MARKETING OF AGRICULTURAL PRODUCE.

At the Meeting of the Council of Agriculture held on October 20, 1927, a Report was adopted as follows:—

(1) That it is of urgent importance that the agricultural industry should consider the better marketing of agricultural produce in the light of the material now available, with a view to securing for the producer greater control over his product than he has at present.

(2) That among the primary objects to be aimed at are closer touch with the consumer and better standardization both in the quality and quantity of supplies; and that the services which might be rendered in these ways would entitle the producer to receive a larger share of the price which the consumer pays.

(3) That, though the assistance of the State would be necessary in setting up the marketing organization and machinery required for different classes of products, the movement must be primarily that of the producers, success being impossible without a guarantee of supplies.

(4) That in order that producers should be willing to undertake the responsibility for initiating, setting up and seeing through new

marketing systems, they must be certain in advance that the profits accruing shall be secured to the industry.

(5) That the question of benefiting the agricultural community by placing the purchase of wheat and meat, whether home-produced or imported, under national control deserves careful consideration.

(6) That the Council of Agriculture for England may take a useful part in the movement for better marketing by preparing a report covering the scope of the above resolutions and indicating the practical steps which would be required, and that to this end the Standing Committee be instructed to act as they may think best, with a view to presenting a draft report at the next meeting of the Council.

The Standing Committee in response to this instruction, and bearing in mind that a Report was required for the next meeting of the Council normally to be held in December, decided to make a rapid survey of the field of agricultural marketing, taking into consideration the evidence of the Reports of the Economic Series issued by the Ministry and of certain selected institutions and individuals who had given special study to particular aspects of the matter, and to make a Report stating the views to which it had arrived after consideration of the facts and ideas so reviewed.

The Report, therefore, does not pretend to go in great detail into the subject, or to be more than what the Council requested, *viz.*, an indication of the practical steps which seem to be required to obtain an improvement of the present position. It will be noted that the question referred to in paragraph 5 above, *viz.*, the purchase under national control of wheat and meat, has not been dealt with. The Committee agrees that it deserves careful consideration, but the exhaustive inquiry necessary to enable a useful opinion to be formed on the subject would take more time than the Committee had at its disposal. It proposes to give separate consideration to the matter at a later date.

The principal agricultural products concerned are dealt with individually in the following paragraphs, and notes on the subject of Transport and Co-operation follow. The Committee is indebted for memoranda on some of the reviewed subjects to the Ministry of Agriculture, the Horace Plunkett Foundation, the Agricultural Economics Research Institute at Oxford, the Agricultural Economics D partment at Aberystwyth, the School of Agriculture, Cambridge University, and the other authorities mentioned in the Report.

It should be added that when it became apparent to the Standing Committee that conditions in Wales would be considered in connexion with the Report, the Committee decided to invite the co-operation of the Council of Agriculture for Wales. This was done, and it was accorded by the meeting of the Council for Wales on December 16, two members of that Council (Mr. Wm. Edwards, of Hologwyn, Llanddaniel, Gaerwen, Anglesey, and Mr. W. A. Howell, of Lletai, Pencoed, Bridgend, Glam.) being deputed to act with the Committee in its work.

Cattle, Sheep and Meat.—The marketing of cattle and sheep and the wholesale marketing of their meat are dealt with together. The Ministry's publications are Report No. 6 of the Economic Series, on the Foreign Meat Trade, and Reports Nos. 13 and 14, on the Markets and Fairs of England and Wales. It is understood that a Report on home-produced supplies, dealing with the Marketing of Store and Fat Cattle and their meat, is now in preparation, and that a Report on Sheep, Mutton and Lamb will follow later. The Committee's remarks are made subject to any fuller enlightenment which may come from those as yet unissued reports.

The Committee thinks it is not too much to say that the existing marketing methods in regard both to cattle and sheep in this country are unsatisfactory, and, as a rule, operate seriously against the interests of farmers. As regards both fat and store cattle and sheep, these are, in some parts of the country, so much in the hands of dealers and auctioneers who give credit to farmers that the full benefit of the best possible marketing of them is rarely secured to the industry. As regards fat stock, it would be better, under present conditions, if selling by weight were universal. Sales, particularly of fat stock, without weighing, lead as a rule to a definite loss to the farmer, and sales at small markets which are dominated by a few dealers should be avoided wherever possible. On this point it was represented that there were too many small markets in the country, and that better and more stable prices would be likely to be secured if business could be concentrated in larger auction marts.

The attention of farmers should be directed to the Bidding, etc., Agreements Act which recently came into force.

The questions of co-operative sale, and co-operative slaughtering, and sale of dead meat were also co .sidered, but the Committee agreed that, although in the interests of sound marketing, such means of obtaining general improvement seemed impracticable at the moment in view of the farmers' present attitude towards co-operation. The examples of some co-operative slaughteries that had been set up showed that the farmer would send only his inferior stock to them, reserving his better stock for the fat stock markets, or for sale in other ways, in the hope of getting better prices. While this attitude remains—as it seems likely to do in the absence of any general schemes for co-operative sales or co-operative slaughtering and sale of meat—it does not appear to the Committee desirable to press the matter further. It would be different if farmers could be induced to try a large scale experiment in the direction indicated, binding themselves to send all their beasts through the one channel. Co-operative slaughteries over the country could work in close contact with each other, thus stabilizing price and output. Gluts at particular markets would not occur with such machinery working properly, as farmers would be advised to hold beasts back, or would be rationed in regard to sales, so that firm stable prices would be the general rule. The effect of such a system could be made to be somewhat similar to that in operation in the war period, when all cattle presented at the fat stock markets were graded and sold at fixed prices according to grades.

This brings the Committee to the question of quality. It appears that there is plenty of room for the further grading-up of stock. The scrub bull should be eliminated, and our prime beef should be produced only from those animals capable of being matured early, and of providing first quality meat. If it is true that the market has definite requirements, such as smaller joints and smaller cuts than formerly, then the farmer, in fatting beasts for the best beef market, should have these points kept well before him. He should breed the best possible beef for that market, and, when submitted for marketing and before he is paid for it, it should be graded as to quality, and his payment should be according to that quality. It should be possible for farmers to work out a scheme for general application throughout the country on some such lines, especially if they could be assisted by Government in laying down in writing definite standards for first, second and third class meat, so that the classifications in all markets over the country would be as near as possible alike. Cold storage might possibly be found to be of great use in holding surplus meat supplies off the market and in bringing them into right condition for consumption. Action in this direction

would undoubtedly improve the position of home supplies on the market, as compared with imported supplies.

The Committee considers that progress along these lines, if made on a general and national basis, would be likely to improve prices to the feeders of cattle in this country, and that piecemeal and local efforts at improvement would be of little, if any, avail.

The Committee is aware of farmers' discontent with the low prices of meat, especially beef, and of their conviction that the margins between the producers' and consumers' prices are unjustifiably wide, and that these margins have tended to increase in recent times. As far as its knowledge extends, the Committee shares the opinions of the farming community, and it recommends that the attention of the Ministry of Agriculture and the Food Council should again be directed to the position.

Pigs and Pig Products.—The Ministry has issued Report No. 12 of the Economic Series on the Marketing of Pigs. Pig products are to be dealt with in Report No. 17, now in preparation.

It is understood that a Pig Industry Advisory Committee is being set up by the Ministry "to consider the circumstances affecting pig production in England and Wales, with special reference to methods of marketing, and to make recommendations with the object of increasing the home supply both of pork and bacon." This Advisory Committee will no doubt have all the information available in both Reports, and otherwise, placed at its disposal. It is hoped that the Committee will be able to make concrete recommendations on this important subject before very long.

We venture to express this hope in view of the serious set-back which the pig industry has recently encountered through the drop in the price of pigs and pig meat in this country. Apart from this, however, there is, in the Committee's view, extensive scope for improvement in the organization of the industry itself. Under present conditions, it suffers severely from considerable fluctuations in prices of both pork and bacon, and of pig-feeding stuffs. The wide extent of these fluctuations could be diminished by improvements in market information and better organization within the industry itself. It should be possible to supply forecasts of probable supplies from foreign markets for a period of six months ahead, so that pig producers might be advised —bearing in mind the average consumption of pig meat and bacon at the usual prices—what quantities they have to furnish to make up the total of normal requirements. From this information they could deduce whether it was or was not a fair business risk to increase their individual stockings of pigs. Information of the kind issued by the Ministry of Agriculture, with duly expressed safeguards as to the use of it, could not fail to be of great assistance to the industry.

It goes without saying, that the industry must continue its efforts in the production of more of the best grade pigs suitable, respectively, for the bacon and pork markets. Generally, farmers should breed and feed pigs definitely for one or the other, and should take care to acquaint themselves with the precise requirements of each, and aim always at producing them. A supply of more of the best quality pigs might do something to keep the markets from falling too rapidly or too low in bad times, since there would be more pigs grown suitable for bacon factories, which could then be kept at full pressure during such times.

Cereals.—With regard to cereals, we were provided by the Ministry with a note indicating its views and those of the Royal Commission on Food Prices, 1925, as to the great practical difficulty in the way of stabili ing prices of wheat (and meat) by means of State control of imports. As explained in an earlier paragraph, however, we did not

see our way to explore this subject in connexion with this Report. The Ministry's Report on the *Marketing of Cereals in England and Wales* is still in preparation, so that our conclusions have been reached without the advantage of considering it. They are, therefore, liable to review in the light of the Report (No. 18, Economic Series) when issued.

The Committee does not propose to follow in detail the existing methods of marketing cereals in this country. The Committee will deal, moreover, only with wheat in its remarks, this being the chief cereal, and the one whose improved marketing, if it can be obtained, will give the lead to improving the marketing of the others. At present, the trade buys wheat on sample, usually conditioning it for milling, where necessary, after purchase, and uses it for mixing with the harder wheats from abroad in breadmaking, or for making biscuits, or for stock and poultry feeding, or for seed purposes.

Putting aside the consideration of improvement of price by tariff restrictions, or any possible statutory regulation of the proportion of overseas flour used in breadmaking, it seems that one way of improving prices to the farmer is by improving the methods of dealing with the crop and marketing it.

Experience in our Dominions, where the crop is dealt with on lines generally admitted to be better than our own, shows that through the system of immediate warehousing of the crop the best financial returns are obtainable. In Australia, voluntary wheat pools for the individual States are the general rule, and in Canada the three big wheat pools account for the bulk of the crop. All provide for the taking over of the wheat in bulk directly after harvesting, grading it, and storing it in grain elevators until sold and exported. It is an essential part of the pooling plan that farmers are able to obtain substantial cash advances on their crops as soon as they are graded and sent into store.

The grain trade in this country is so different from that of the big exporting countries that it does not seem possible to adopt an exactly similar plan here. There are such special considerations as the function of local mills, and the useful part they play in supplying the farmer with the excellent offals that come from the milling of his own wheat; there is the question of the considerable loss of weight of the British wheat crop, especially in a wet year like the present, on its conditioning and storage. These and other complications have to be considered. None the less, it appears to us that if the Government could see its way to provide storage accommodation, by renting it in existing elevators at the chief ports, or helping in the erection of it at suitable points in the country, the grain trade could be relied upon to assist in the economic handling of the crop. There seems little doubt that some of the largest buyers of wheat would in normal seasons be willing to buy far more home-grown wheat if they could buy it in bulk and properly graded.

There seems to be no doubt that the efficient conditioning and storage of the crop immediately after harvest would be an advantage over the present system, both from the national point of view and from that of the farmer.

More of the crop would be harvested and kept on hand, and the farmer should get a better return for it than he does under the present haphazard method of selling. If he keeps his crop in the stack there is bound to be a certain wastage through the winter by vermin and other causes—a moderate estimate puts loss in an average year at about 10 per cent. By a system of proper storage that definite loss of grain would, of course, be avoided. On the other hand, there would be the loss of weight in the grain through its drying out and its subsequent conditioning, which would make the bulk the farmer has to sell at the higher prices of the following year much less than it would have been had he sold at harvest-time. Conditioning and storage at convenient

points not too far away from the centres of his trade would none the less appear to be of undoubted advantage. As an alternative, or as a supplementary measure, it might be possible to erect local drying and storage plants in connexion with local mills in the country. If that could be done it would save cost of transport where the wheat would eventually be required for local milling.

The whole subject, however, bristles with difficulty, and the Standing Committee does not at present propose to go further than to recommend that the question should be examined by experts, who should be asked to endeavour to prepare a scheme within such limits as the Government might be prepared to go in assisting the industry in this direction. In our view, an essential effect of the scheme should be to make cash available to the farmer immediately after harvest and storage, on the security of the crop delivered.

Liquid Milk.—The Committee had before it Reports Nos. 1 and 16 of the Ministry's Economic Series, dealing respectively with *Co-operative Marketing of Agricultural Produce*, and the *Fluid Milk Market* (Mr. Forrester's Report), and also memoranda from the Agricultural Economics Research Institute at Oxford, from Mr. A. W. Ashby on marketing of milk in Wales, and a note by Dr. Ruston, of Leeds University.

On the broad facts of the industry, the Committee is agreed that there has been a considerable increase in the quantities of liquid milk marketed in recent years, and that with the unfortunate experience in corn-growing in these same years, more land is likely in the near future to be laid down to grass for dairy purposes. The production of liquid milk will, therefore, respond readily to the call of the markets for more milk. The Committee is convinced also that there has been improvement in the quality of the milk marketed, and that this is the main reason for the greater confidence placed in it, which is reflected in its increased consumption. If it could now be reduced in price to the public, whilst the farmer retains a fair return for his expenditure and labour as the producer, the consumption would still further increase, and the use of imported condensed milks, some of which are totally unfit for feeding infants and growing children, would be at least proportionately discontinued.

Although in some cases the wholesale marketing of milk in this country appears to us to be conducted economically, the farmer does not often get the benefit of this. He would if pooling supplies and co-operative marketing were resorted to. From the farmer's point of view the only really satisfactory method of marketing milk is the co-operative method. At present the price is fixed for him by bargaining between the National Farmers' Union and the representatives of the distributing trade, although separate contracts are made between the chief distributing companies and individual farmers which may not be so good as the agreed average price would lead one to expect. These contracts have regard to local conditions as well as to the fixed seasonal prices. If the farmers were prepared to combine for the purpose of sending their milk to co-operatively owned depôts or to town selling centres for the depôt, there seems no reason why it could not be dealt with quite as economically as it now is by the distributing trade. The financial returns from the production of it ought certainly to be much increased. As a development of such a system, if it could be started, the farmer might be paid by his co-operative society according to the quality, as well as quantity, of the milk he delivers.

The co-operative societies would also be in a position to deal directly with the supplies of milk which were surplus to immediate requirements. At present, many milk producers find themselves at a disadvantage in

spring and summer, when their cows are in the flush of milk, in having to dispose of surplus milk at a much reduced price. Obviously, the position of the farmer in regard to this milk should be improved. It can satisfactorily be done only if he himself or his co-operative society undertakes the manufacture of such milk into cheese or butter, or possibly into tinned condensed whole milk, or finds an outlet for it as fresh milk.

In the absence of a scheme for co-operative selling and manufacture, the Committee agrees that the present system of collective bargaining with the distributors—which in itself indicates a start in the understanding of co-operation—is the best that can be adopted, and it would follow the lead of Mr. Forrester's fluid milk report, and recommend collective bargaining in each of the six chief markets of England and Wales, as likely to lead to closer and more detailed organization of producers. The Committee understands that the market in South Wales is very weak in its power of combination, and suggests that special attention be given to milk marketing in that area. It would be an advantage also if the nomenclature of the grades of milk (Certified Grade "A," T.T., etc.) were abolished, as the same Report suggests, and "Standard," "Super-standard" and "Special Standard," or other clearly understood terms, substituted in their place.

A good deal has been said and written recently on the iniquity of the large and growing importations of tinned skimmed milk. With much of this the Committee agrees, as it is clearly bad national management if skimmed condensed milk from abroad is allowed to take the place of whole milk produced at home in the feeding of infants by poor and ignorant parents. At the same time, the Committee considers that the practicable way to the remedy is not through the prohibition of the importation of skimmed condensed milk, but rather by assisting a wide publicity which will bring home to all classes the cheapness and value of home-produced fresh milk as a food.

Cheese and Butter.—The Committee does not propose to go more closely into the marketing of the milk products, cheese and butter, but to offer a few general observations only on them. The manufacture of butter in England and Wales is more or less localized in districts which have not ready access for the sale of their milk to the big consuming centres. As a rule, butter from these districts finds a good sale at fair prices in whatever quantities it is marketed. It is likely, however, that its marketing is capable of improvement when it is considered how varied must be the qualities of consignments, and how unequal the supply, the industry being, as a rule, quite unorganized.

As regards cheese, grading schemes have already been put into operation by certain groups of makers of Cheshire and Cheddar cheeses respectively, acting in concert, at the suggestion of the Ministry. The idea of both schemes is centred in a trade-mark which can be used by makers whose cheeses are judged to reach a certain standard. The responsibility of judgment rests with a specially appointed "grader." Both schemes were started only last year, and are understood to be giving encouraging results.

In the case of the Cheshire Cheese Federation, the makers' premises and equipment have to be inspected and passed by the grader in the first instance. In the case of the Cheddar Cheese Federation, endeavours have been made to market trade-marked cheese direct to the retail trade. Otherwise, the arrangements of both Federations are much the same. The schemes are financed by a levy of 2d. per cwt. on cheeses sold thereunder and by a small annual subscription by each member. The Ministry has made a grant in aid of the first year's working of each scheme, out of the funds placed at its disposal by the Empire Marketing Board.

If these schemes continue to be successful, and achieve the object of obtaining better prices for the associated producers' wares than would otherwise be obtained, they must in the natural course be followed by other groups of producers whose cheeses come into competition with trade-marked cheeses in the market. The producers of Stilton and other local cheeses would probably find it an advantage to follow these pioneer steps in co-operative marketing.

Eggs and Poultry.—The Committee consulted the Ministry's Report on the *Marketing of Eggs and Poultry* (No. 10, Economic Series), and the special leaflets on the production of eggs and poultry and their subsequent marketing, which have been issued by the Ministry in connection with its demonstrations at the principal Agricultural Shows in 1927.

In the case of eggs, for their more efficient sale in this country, two chief requirements appear to be necessary. Firstly, that definite standards should be laid down for first, second and third qualities, and secondly, that the wholesale sale of eggs should be made according to those standards. These requirements have already been adopted in Northern Ireland and the Irish Free State to the considerable advantage of the trade. There is no question that the sale of eggs by weight in place of sale by number is more just and satisfactory from both buyers' and sellers' points of view. The Committee understand that the Minister of Agriculture has recently received advice on these subjects from the Poultry Advisory Committee, and that the bodies chiefly concerned are being consulted. Presumably, the receipt of such advice will be followed by legislation governing sale according to the standards recommended.

If events travel in the direction foreshadowed above, improvement in the selling organization of egg producers will be necessary. This, in the view of the Committee, might be obtained by :—

(*a*) An extension of the system of central collecting, packing and grading depôts, and

(*b*) The extension of cold storage facilities for eggs.

The Government might assist by arranging facilities both in regard to (*a*) and (*b*), providing producers showed the requisite initiative and desire to use such stations and storage.

It is clear as regards (*a*) that the collecting, etc., stations would be essential for the proper out-turn of the standardized produce. Such stations might also be used for poultry conditioning, killing, and treatment for market.

As regards (*b*), the question of the greater utilization of cold storage to carry over surplus supplies from the months of plenty to the autumn and winter times of scarcity is one of undoubted importance. Cold storage, or a modification of it, according to the best knowledge of the science of preservation at low temperatures, would appear to be effective for the economic preservation of eggs, if it could be used on a large enough scale. Many producers preserve in water-glass and by other means but the quantities are comparatively small. If the large cold stores over the country, which the Committee understands are far from fully utilized at present, could be used in connexion with the storage and preservation of large quantities of eggs, it would undoubtedly be a boon to the industry, if only for the stabilization of prices which would ensue from a more even distribution of supplies of eggs throughout the year.

The Committee understands that the question of the marking of imported eggs has also been considered by the Poultry Advisory Committee, so that it does not propose to express an opinion on this matter at present, except to say that it is desirable, as soon as possible, to safeguard the credit of English fresh eggs by making impossible the mixture with them and fraudulent retail sale as English eggs of cheaper foreign eggs.

Wool.—The Committee had before it the Ministry's Report on *Wool Marketing in England and Wales* (Economic Series, No. 7), and also a memorandum giving information as to the position in regard to the improvement of wool breeding in the country through the work of the Wool Breeding Council, and in other ways.

Already improvement in the marketing of wool by farmers' organizations is becoming evident. In the case of the most recently formed co-operative society, *viz.*, that for the Eastern Counties, no less than 40,000 fleeces were dealt with last season, all graded by the Society's grader, and sold on the London Wool Exchange. There is little doubt that if farmers will combine for this purpose, and place clean wool, properly graded, on the London Wool Exchange, a substantial improvement over the prices given at local auctions will be obtained. Fewer and bigger wool auctions in the country than at present would undoubtedly be a distinct improvement from the farmers' point of view, whether co-operative action is secured or not.

Fruit.—In the case of fruit, English produce comes into closer and more obvious comparison with imported produce than is the case of any other home-grown foodstuff. Imported fruit, particularly apples, has for a long time been put upon the home market well packed and graded, and there is no doubt that there has been a definite improvement in recent years in the manner in which the better classes of home-grown fruit have been marketed. It is likely that this improvement is due in some considerable measure to the competition from overseas.

There is, however, still much room for greater advance, and the Committee thinks that improvement would be more quickly and generally made, and better returns secured for producers, if co-operative fruit-packing stations were set up at suitable centres over the country. The initiative in the matter should come from the fruit growers themselves, although it would help very considerably if the Government could see its way to assist a scheme on national lines. The Committee recommends the fruit-packing station because it is the sure way to obtain, as far as possible, uniformity of output when dealing with the produce of a large number of farms, and uniformity and reliability are the chief requirements of the wholesale fruit markets. At present, the market returns on sales of fruit are often very small in proportion to the high returns from retail sale. There may be good reasons for this in some cases under present conditions, but the disparity appears to the producer as a rule to be wholly unreasonable and unjustified. A third substantial reason why fruit-packing stations should be established is that they provide a ready means of dealing with gluts of particular crops in different seasons. It would be part of the business of at least some of the stations to make jams and preserves on a factory scale, and thus the produce of each fruit farm connected with the co-operative or other society which runs the station would be certain to be used to the full, and in the most paying way possible.

The Committee also recommends that a system of national marks should be employed on the packages of fruit sent out from the stations, and that they should refer to fruit of the same standard, so that the market would have confidence in grade and quality. It is possible also that national marks might be used by individual growers, who for some reason worked independently from fruit-packing stations; these would be members of an association empowered to use the marks, and it would be a condition of membership that their produce should come up to certain standards prescribed. If the mark were used on goods below standard, then the right to use it would be forfeited.

The Committee considers that in the case of other produce, as well as fruit, the use of national marks as a guarantee of quality to the consumer should be widely employed, and their credit jealously guarded by associated producers. The wide adoption of the use of cheap non-returnable packages, which could be made of standard sizes in large quantities, would also help considerably to simplify and benefit the industry.

Potatoes.—The Committee has had before it the Ministry's *Report on the Marketing of Potatoes in England and Wales* (No. 9, Economic Series). It appears that the outstanding defect of the marketing of potatoes to-day is, again, the lack of adequate sorting and grading by the grower. He frequently sends to the wholesaler consignments of potatoes of all sizes, which may contain diseased and damaged tubers as well as a fair amount of earth; more rarely two or more varieties may be mixed together. The wholesaler naturally pays less for a consignment of this quality, or indeed for any unsorted crop, than he would for a sorted crop in sound condition. The Ministry of Agriculture recommends the grading of potatoes into firsts, seconds, and thirds, over and above the sorting of good from bad, and "chats" from "ware." In our view, the whole question is worth the careful consideration of representatives of growers, wholesalers and retailers. If they agree as to standards for grades, then a regular system of marketing, commencing with proper sorting by the grower or his representatives, could be started, to the certain benefit of the producer and to the simplification of the trade. Such a Committee might also consider the best means for disposal of surplus crops. It has been suggested that beet sugar factories should slice and dry surplus potatoes at a time when the factories are not being used for sugar beet, so that a trade could be built up for utilizing surpluses. The Committee has no information as to whether the preservation of potatoes in this way, or their utilization in some other way as foodstuffs for home consumption, is preferable to developing again an export trade in seasons of plenty, but it also deserves careful examination.

The Ministry's demonstrations of grading, packing, marketing, and cooking, which have been given at various Shows in the past year, with the object of improving the marketing and also the home consumption of potatoes, are, the Committee thinks, much to be commended.

Transport.—The question of improving facilities for the transport of agricultural produce to its destined markets or to the centres of consumption is a general one which seriously affects practically all agricultural commodities. The Committee understands that rates for the same weight of the same produce differ over the same distances in different directions—that with some goods the rates are out of proportion to the value of the produce—and this in some cases acts as a strong deterrent to their continued production. All kinds of anomalies are alleged, and it is widely considered that unsuitable railway rates and charges constitute a considerable drag on agricultural prosperity.

There are undoubtedly cases where complaints of high freightage and delays are justified, but there is also machinery, somewhat cumbrous perhaps, for obtaining improvements and redress. Considering the immense volume of goods traffic entrusted to the railroad, complaints do not seem to be proportionately numerous. In our view, it were better if farmers tackled the question from the positive side of better organization of supplies rather than from the negative side of complaining of the operation of principles which the railway companies consider necessary to keep in operation if the railroads are to pay their way.

If farmers produce schemes for pooling their produce, and take to a railway company a proposition for bulked traffic with a request for favourable rates in respect of it, they will, in our view, be proceeding on sound lines. It appears that the peculiar requirements of the strawberry traffic from Hampshire, and the fruit traffic from Wisbech, and those in other cases which could be named, can be adequately and economically met by the railway companies, and there seems no reason why other special traffic should not be similarly dealt with.

The position of the railway companies in dealing with farm produce would no doubt be improved if they had power to run motors over the roads in the areas which they cover, with a view to a properly co-ordinated transport service.

So far as complaints of existing traffic rates, etc., are concerned, the Committee understands that it is the duty of the Ministry of Transport and the Railway Rates Commission to deal with them. The Committee considers that it should be the business of the Ministry of Agriculture, as the special guardian of agricultural interests, actively to take up cases with those authorities where inquiry seems justified. The Ministry would, at least, become fully acquainted at first hand with the anomalies which exist and with the ground for any general changes that seem necessary, and would then be in a position effectively to advocate them.

Agricultural Co-operation.—The Ministry has issued three Reports on this subject in its Economic Series, namely, No. 1, *Co-operative Marketing of Agricultural Produce in England and Wales;* No. 4, *Large-Scale Co-operative Marketing in the United States;* and No. 5, *Co-operative Purchase of Agricultural Requisites in England and Wales.* In a recent year the total sales of produce by Agricultural Co-operative Societies—apart from sales of cereals by joint trading societies—amounted to less than five million pounds, or about 3½ per cent. of the total value of home-grown agricultural produce marketed in England and Wales. This figure gives some indication of the present size of the co-operative movement as regards sales, and how much ground there is still to cover before the principle of co-operation can be said to have a real hold of the agricultural industry.

In several of the previous sections of this Report, it has been suggested that improvement in marketing can best be achieved by farmers combining to form societies for various purposes according to their needs. The Committee desires to convey its conviction that marketing has become so important an item in farm economy that the best skill should be used in it; the farmer's primary business is to farm, and selling has a special technique of its own, and in fact is best performed as a separate business. If the farmer is dissatisfied with the prices he at present obtains for ungraded produce, as compared with the prices paid by the consumer for graded produce, perhaps the best way of improving the position is by setting up an agricultural co-operative society, which can condition, grade, pack, and market his goods.

So far several agricultural co-operative societies, set up for different purposes, have undoubtedly turned out successful; others have been failures. It may be useful to summarize the chief principles, the observance of which make for success, as follows:—

(1) Care should be taken to see that a society has sufficient business promised at the start to justify its establishment. There is a minimum of overhead charges which has to be met in a business of any kind, and to be successful, the business must be so organized as to bring in a net return at least greater than this.

(2) There must also be enough capital in the business to provide sufficient liquid assets for its purposes.
(3) A society, for whatever purpose for which it may be formed, should be under efficient management. If the services of a first-class man cannot be obtained, failure is almost certain.
(4) It is essential that members should pass all, or a stated part of their produce, through their society, and be bound by what is known as "suppliers' contracts." Only with the definite undertaking to supply a known amount of produce is a society in a position to employ its machinery adequately and to develop suitable markets. Until the system of suppliers' contracts is general and has been enforced it will always be difficult, and frequently impossible, for a co-operative marketing society to obtain the necessary regularity and volume of supplies. Farmers must therefore be willing where they desire to co-operate to sign suppliers' contracts which will pledge them to stand by their society.
(5) Prospective members of agricultural co-operative societies must be assured that their liability as members would be strictly limited to the shares they have taken up.

In some recent cases the share liabilities of members have been increased without their individually expressed consent. The share liabilities of members are fixed by the Rules of each society, as made under the Industrial and Provident Societies Act and registered by the Registrar of Friendly Societies. Hitherto, it has been possible to change the share liability of individual members by securing an alteration of Rules; and such change could be secured without the express consent of any member if the resolution for the alteration of rules were passed in the manner prescribed in the rules of each society concerned. Action by this method in the case of the Farmers'Central Trading Board and the Agricultural Wholesale Society, Ltd., has caused grave trouble to the local societies which were constituent members of that society (but this did not increase the liabilities of persons who were individual members of these local societies). In other cases similar actions by local societies have caused trouble to the individual persons amongst members who were not fully aware of, or did not agree with, the action taken by the Society to which they belonged.

It is now necessary, therefore, that members (or shareholders) in agricultural co-operative societies should take steps to safeguard their position as regards the fixing of share liabilities. The position might be generally safeguarded by an amendment of the Industrial and Provident Societies Acts. It is, however, possible for each society to secure the position of each of its members in this respect without any alteration in the present law. Some societies have registered rules to this effect.

> "The society shall have no power to increase the nominal value of the shares without the consent in writing of each member."

One such rule reads as follows:—

> "*Rule* 6.—*Shares:* Shares shall be transferable but not withdrawable. They shall be of the nominal value of £1, payable in full on application, and the Society shall have no power to increase the nominal value of shares without the consent in writing of each member."

In the rules of this Society this Rule is followed by another:—

> "*Mode of Amending Rules:* All the rules *with the exception of Rule* 6 may be amended by resolution of a three-fourths majority at a Special General Meeting. No amendment of Rules is valid until registered."

Thus the members of this Society have fixed their liabilities on share capital to the amounts for which they have personally applied, and further liabilities cannot be imposed upon individual members without the express consent of each.

The possibility of making such Rules or securing amendment of existing Rules to this effect should be known by all agricultural co-operators; and the desirability of securing such provision in the rules of existing societies should be considered.

On the question of assisting general development of co-operation, the Committee understands that the National Farmers' Union has now for some time accepted the responsibility for directly fathering co-operation in this country, whilst the Welsh Agricultural Organization Society continues its works in Wales. There is without doubt much that can be done, and is being done, by the Farmers' Union and the Welsh Agricultural Organization Society, and the Committee very much hopes that their efforts will prove increasingly successful. The matter is, however, so important that the Committee suggests that the Government should consider whether it is possible to assist agricultural organization, at any rate where it is concerned with the marketing of agricultural produce, with additional special help and advice. Any expenses incurred in this matter might suitably be defrayed from the grant set apart for the development of Empire Marketing. Whether this can be done or not, however, the Committee would urge that the Ministry of Agriculture should in no way relax its own efforts in proving that co-operative action is essential to prosperity in Agriculture by the practical demonstrations in organized better marketing which it gives at agricultural shows and other centres up and down the country.

The attention of Committees of County Councils and the authorities of Agricultural Colleges who are in charge of extension work in Agricultural Education should also be drawn to the importance of education in relation to marketing problems and methods, as it is clear that their present and previous work in assisting farm production can only be made effective when marketing methods are adjusted to present circumstances.

In presenting this Report, the Committee wishes to express its appreciation of the valuable services rendered in its preparation by its Secretary, who is also the Secretary of the Council.

January 19, 1928.

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MARCH ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
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Seasonal Notes.—March, the month of many weathers, derives its name from Mars, the god who was worshipped most widely among the ancient Italian tribes. As the god of manliness and creative power, Mars came to be best known as the War-god, but he was originally the patron of the husbandmen. As Mars Gradivus he was the god of growth; he received the first fruits of the year; to him the farmer prayed that his flocks and herds might prosper. The bright season of spring—earlier, of course, in Italy than in Britain—was sacred to him. The first month of the Roman calendar was important as a time for the opening of both agricultural and military campaigns; and perhaps the ascendancy of the latter interest

may be inferred from the association of the word "martial" with warfare rather than with farming operations.

March 25, Lady Day, is an important term day in agricultural tenancies. Why so many farm tenancies begin and end on this particular day must be explained by historical reasons; indeed, it would be difficult to justify the adoption of this date on the grounds of farm management. In the twelfth century, the Anglican Church began the year on Annunciation, March 25, which was also the beginning of the ancient Jewish year and the traditional date of Adam's creation. This practice was shortly afterwards adopted in secular affairs, and continued until the reformation of the calendar in 1752. By this time, farm leases, elaborately prepared by lawyers, had become common, and the retention of the Lady Day Term is an example of the conservatism of English customs. In this particular matter, however, it is of interest to note that the Government financial year has not followed the reformation of the calendar.

March is usually a dry month, and, after the rain performance during January and up to the time of writing (the middle of last month), this feature in its reputation will be awaited and critically observed by all farmers. Not only are the arrears of work which accrued in November and December still outstanding, but the land is generally waterlogged, floods are common, and some of the fields sown late with wheat or winter oats will probably require re-sowing. Even after a normal autumn and winter, however, a prolonged dry period in March is proverbially beneficial. "A peck of March dust is worth a king's ransom," recalls the time when our ancestors valued the lives of men in terms of money, that of a churl being £10 and that of a king £60. This year it will certainly be possible to test the saying that March either empties the full ditches or fills empty ones. The objection to a wet March needs no emphasis, but apparently tradition is even more strongly opposed to warm, growing weather at this period: the quotation in full is "March many weathers rained and blowed but March grass never did good." This, of course, may not meet with the approval of the protagonists of "the early bite of grass"; but mild weather in March is often followed by a chilly April, during which the forward growth of early potatoes, raspberries and other market garden crops is liable to be cut back.

The possible influence of wireless telephony is frequently discussed in farming circles, and there are many beside the

considerable minority of farmers who believe that there is some connexion between the spread of wireless broadcasting and the heavy rainfall of the past seven months. It will be remembered that the bombardments in France during the wet weather of 1918 were similarly blamed. There is no known reason to believe that the course of atmospheric depressions and anti-cyclones is influenced in any way by wireless emissions, and there is still less apparent connexion between those phenomena and wireless reception, which, even more than broadcasting, has increased in this country since the wet cycle set in.

Grassland.—On farms where little arable cultivation is practised, sufficient yard manure is available for the meadows to allow of their receiving an application every second year or thereabouts, according to the number of cattle wintered and the rate of dressing. On typical grass holdings, however, little litter is used; the arrangements for conserving the manure made are commonly poor; and, after a wet winter, which prevents the manure being carted on to the land, the quality of the dung available for application in March is decidedly low. In this case, and especially in late districts, a supplementary top-dressing of artificial fertilizers may be necessary to ensure a satisfactory and early mow.

Where a fair proportion of arable land is cultivated, the exigencies of the present season may not permit of the employment of men and horses in manuring meadows during March, when soil conditions allow of necessary arable land operations. Moreover, where good use can be made of all the yard manure for arable crops, it is sound practice to apply it to the ploughland rather than the grass, as the latter does not require the aid of added organic matter to the same extent as arable soil. Continuous manuring of meadows with artificial fertilizers only has been amply demonstrated to be practicable, provided that a complete mixture is used and that precautions against the development of sourness are observed.

Winter Corn.—The effect of the constant wetness has been to puddle the surface of the soil and restrict aeration. Consequently, on the medium and heavier classes of land, the plant has become thin, and there is likelihood that it will be slow to move forward. Under these conditions, nitrogenous stimulation is advisable, and the loosening effect of the harrows is beneficial. Many farmers roll their wheat and other winter corn as early as the land will bear the team and implement, but frequently the roller does considerable harm, and the foot-

prints of the team persist as bare patches. Rolling has its uses, but the compression of soil that is damp underneath is not one of them.

Spring Corn.—There is ample evidence of the general excellence of the oat varieties, Victory, Golden Rain and Crown, which have been tested repeatedly in experiments and in practice since about 1911. All do well on good land; while under conditions which are locally thought to be suitable only for oats of the Black Tartarian type, these newer varieties always excel the Tartarians in yield when compared in properly conducted experiments. The preference for the Black Tartarian oat in upland and wet districts is difficult to justify on economic grounds, and the only plausible explanations obtainable are the questionable ones that Black Tartarians are less liable to sprout in the sheaf and have straw of better feeding quality than the newer varieties above mentioned. Certainly the straw is longer and weaker; but this is attended with greater liability to lodging; and if Golden Rain, for example, is more liable to sprout in the sheaf, this is due mainly to its earlier ripening habit, which is as often as not an advantage for cultivation in late and upland districts.

Strength of straw is not infrequently an important factor in the selection of oat varieties. Under certain conditions, Victory and Golden Rain do not stand sufficiently well; this may be the case where oats follow well-manured roots on good, moist land, or where oats follow a three or four years' lea containing abundance of wild white clover which has been grazed during the last two or three years of the period. There are, indeed, no varieties that may be relied upon to stand well under all weathers after a rich clover lea, but Record and Yielder may be mentioned as among the best for this purpose. Marvellous, a white winter oat, is a stiff-strawed sort, and succeeds very well when sown in March.

The advisability of sowing liberally when putting in oats of the modern large-grained type has been emphasized in previous notes. This year, an additional reason for liberality in seed allowance will occur on many farms where the quality of the seed available is definitely below the average of previous years; indeed, really good samples of seed oats are not very common this season.

Where spring corn is sown on lea ground, it is advisable to keep a look-out for the leather jacket grub, which may be expected to be a common pest after the wet summer and autumn of 1927.

Live Stock.—March is a busy month with young animals of all kinds. It is the principal lambing month; the "spring" litters of pigs arrive, or have already arrived; foals appear; and, on the average, more calves are dropped in March than in any other month of the year. The suitability of March as a month for the hatching of chickens intended for winter egg production needs no emphasis to progressive poultry-keepers. The feeding of sows for growth of the young pigs has in recent years been much improved by the use of fish meal, or substitutes for the protein and mineral constituents which fish meal contains. The same principles, however, have not generally entered into the management of ewes and mares with offspring. Hay and oats are still too commonly the ration of the mare suckling a foal during the indoors period, and the addition of bran, while it is an improvement, is not a sufficient enrichment in protein to enable the dam to produce a liberal flow of milk. In the case of ewes and lambs, a different supplement of concentrates is needed during the month of March, when little green food is available, from that which is suitable when the flush of spring grass has arrived. Cereal foods—oats, barley, maize—may be quite satisfactory as an addition to spring grass; but, when the basal ration of the ewes is roots and long fodder, the concentrated supplement should be more on the lines of the cakes and meals fed to cows in milk.

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NOTES ON MANURES FOR MARCH

H. V. GARNER, M.A., B.Sc.,
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Manuring of Sugar Beet.—The results of experiments on the cultivation and manuring of sugar beet carried out in East Suffolk have recently been published.* Some of the points brought out with regard to the effect of manuring may usefully be mentioned. The addition of 10 tons of farmyard manure to a complete and generous dressing of artificials (consisting of 4 cwt. basic superphosphate, 6 cwt. kainit, and 3 cwt. nitrate of soda per acre) increased the yield from 9 tons to 12·7 tons per acre, and had no appreciable effect on the sugar content. Experiments with increasing quantities of a fertilizer mixture, used in the absence of farmyard manure, showed good increases for 6 cwt. of artificials amounting on the average to 27 cwt. of beet; a double application of the same mixture only produced

* East Suffolk Education Committee, Report on the Results of Sugar Beet Trials, 1927.

a further 15 cwt. of roots. It was pointed out that better results were obtained on land in high condition than could be produced by heavy doses of artificials used in impoverished soil. The effect of nitrogenous dressings without dung, but in presence of a suitable addition of phosphate and potash, was to give 39 cwt. of beet per acre for the application of 2 cwt. of sulphate of ammonia in the seed bed, a further 22 cwt. of roots was obtained by a top dressing of 1 cwt. of nitrate of soda; while an additional top dressing of 1 cwt. of nitrate applied separately from the foregoing produced only 6 cwt. more.

The only sign of a depression of sugar content occurred in the final case, where 2 cwt. of sulphate were used in the seed bed and 2 cwt. of nitrate were applied on top. The heavy dose of nitrogen, by forcing a great leaf growth, made the crops look better than they actually were, an observation which was made at several experimental centres last season.

The time of application of nitrogenous dressings seemed to make little difference either to the yield or sugar content: in some cases all was given before drilling; in others, part was given at singling time, and the remainder three weeks later. A small series was set out to test the effect of varying quantities of potash. The soils were light or medium and had received dung or potash in 1926 or 1927. Under these conditions, potash was not very effective. There was no advantage in increasing the dressing of muriate of potash from 1½ to 3 cwt. per acre.

Green Manuring.—Farmers are agreed on the great part played by organic matter in their arable land. There are only two ways in which this most important constituent is restored in quantity to cultivated soils. These are (1) the application of farmyard manure, and (2) green manuring. The almost universal use of dung, and the relative rareness with which green manuring is found as a regular feature of farming in this country, is more a measure of their suitability to existing practice than of their effectiveness as a means of restoring fertility to the land. In any case, a dressing of dung is more beneficial than an equal weight of green manure, but the fertilizing effect of a successful green manuring crop can be quite considerable, especially if a leguminous crop is grown with the help of a good supply of phosphate, potash and lime. Some of the conditions which make for the success of green manuring are: (1) The production of a large bulk of green stuff to be turned in before it has become too woody. (2) As high a nitrogen content as possible in the green material, this

helping the decomposition in the soil and providing nitrogen for the following crop. The best way to secure this is to use a leguminous plant. (3) The mass should be ploughed in shallow enough to enable free aeration to take place, and the presence of a good supply of chalk in the soil is an advantage. Under these three conditions the land is enriched in organic matter and bacterial activity is increased. This results in the liberation of plant nutrients and an improvement in physical conditions. A green manuring practice which might receive consideration at this time of the year is the under-sowing of cereal crops with clovers, with a view to turning in the clover sod in autumn for potatoes or sugar beet. The advantage of this plan is that the operations are merely those which are regularly undertaken to secure a seeds ley, and call for no special deviations from usual farming practice. The risks are, as with leys, that in a dry spring the under-sown crop may fail, or in a wet growing season the clover may give trouble in the butts of the sheaves at harvest. As a rule, however, a satisfactory plant is obtained which can be ploughed in with good effect for roots, or, if keep is short, may be used for live stock.

Fertilizers for Gardens.—Vegetable growers have in the past relied chiefly on bulky organic manures, and their more concentrated materials were those used by farmers before the introduction of chemical fertilizers. Farmyard manure, lime, bone meal, guanos, wood ashes and soot are still the chief sources of fertility in many gardens. The tendency is, however, for the supplies of some of these materials to decrease, or at least fail to keep pace with expanding requirements. On the other hand, commercial artificial fertilizers are being produced in greater quantity and variety each year, and their use is gradually finding favour among gardeners and allotment holders. Even with a plentiful supply of the older materials there would still be a place for chemical fertilizers, in particular for nitrates, where rapid leaf development is essential, as for spring cabbages, and for potash salts to aid the growth of root crops on light soils. Where dung and organic nitrogenous materials are scarce, growers must fall back on other sources of plant food, and this will chiefly be supplied in the form of artificial manures. It is to be noted, however, that of all cultivators, gardeners have the greatest esteem for organic matter, and this is not directly supplied in the concentrated manures, consequently every effort should be made to make the existing quantity of dung go as far as possible and to help

it out by turning under vegetable residues or green manuring crops specially sown for the purpose. For general work a complete fertilizer is wanted, that is to say, one which contains all three fertilizing ingredients. A mixture as applied for potatoes in farming practice is quite suited for ordinary garden use. It might be made up of—

2 parts sulphate of ammonia, or equivalent quantity of nitrate of soda or of cyanamide.
2 parts sulphate of potash, or equivalent quantities of muriate of potash or of Kainit.
3 parts superphosphate.
1 part steamed bone flour.

Since the matter of expense is not so urgent in small-scale operations as it is on the farm, some of the nitrogen might be supplied in the organic form as rape cake, fish guano or meat meal, thereby improving the condition of the mixture and providing a slightly more lasting form of nitrogen. Growers would be advised, where possible, to purchase the ingredients co-operatively in bag lots put up by the makers, as considerable saving in price is secured by buying in quantity.

Garden culture produces bigger crops than are ordinarily obtained on farms, with consequent greater drain on the soil; somewhat heavier dressings of manures are therefore in place, and 3 oz. per sq. yd. of such a mixture would not be too much for garden crops. When using artificials in this quantity even distribution should be aimed at, or injury to germinating seeds may result. The fertilizer mixture may be diluted with an equal bulk of sand or ashes before application, and should be well worked into the surface soil.

Those who do not wish to take the special care necessary to succeed with chemical fertilizers can manage quite well with such substances as high-grade guano, meat meal, or fish meal; but on light soils these materials may need to be supplemented with potash salts from time to time. The organic manures have the advantage of simplicity and safety, but if the mineral fertilizers are rightly used no damage to crops need be feared from dressings on the scale mentioned above.

Manuring and Quality.—Attention has recently turned to the effects of manuring on the quality of crops. This applies to sugar beet, barley, potatoes, and to an increasing extent to wheat. A further aspect of manuring which is now receiving study is the possibility that varieties of the same crop may differ in their responses to fertilizer treatment. We may have

our varieties classified not only according to their suitability for high farming or the reverse, but also in relation to their needs for lime, potash and so forth. The investigation of these problems is complicated by the fact that the nature of the soil and the type of season each affects the result, and this, no doubt, accounts for the lack of agreement found in the conclusions of different workers.

An investigation recently carried out in Germany† is of interest because the effect of 10 different manurings was studied on six varieties of spring wheat under pot-culture conditions. Five of the wheats were local varieties or selections from them. They had the reputation of being early, hardy, and of rather low but certain yielding power. The sixth variety differed in being more suited to high farming conditions, it was later, and produced a more starchy grain than the others.

The soil was deficient in potash, and without added potash, nitrogen was ineffective. There was no marked response to phosphate. The results brought out clearly the opposite effects of potash and nitrogen under the above conditions. In the absence of potash, germination was delayed, growth was soft, and the plants suffered badly from mildew and aphis. Addition of potash corrected these effects, while it also—

(1) Improved the straw;
(2) Increased the proportion of grain to straw;
(3) Increased the percentage of head corn;
(4) Raised the 1,000-corn weight and the starch content.

The action of nitrogenous manure was, in general, in the opposite sense, although complete manuring gave the best result when both yield and quality were taken into account. Phosphate had little effect on yield, but increased the 1,000-corn weight in all varieties. The nature of the grain, whether rich in protein or in starch, was a varietal characteristic, the late variety being more starchy under any one treatment than any of the others. The composition of the grain was affected by manuring in all varieties: nitrogen increased the protein, potash increased the starch.

The intensive variety differed from the rest in its reaction to manures, being the only one which could respond to nitrogen and phosphate in the absence of potash. It was pointed out that, in the field, other factors were important which did not operate in pot-culture; for example, the variety

† Dr. K. Weller. *Der Einfluss d. Düngung auf den Ertrag Güte und sonstige Werteigenschaften, etc.* (The Influence of Manuring on the Yield, Quality, and other Properties of six varieties of Spring Wheat). Published by Dr. F. P. Datterer & Cie, Freising (Munich), 1927.

which did best under all treatments in the pots were so damaged by gout fly in the field, owing to its late habit, that it was outyielded by the others.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending February 8				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	12 10	11 15	11 7	11 7	14 8
,, lime (N.13%) ..	..	..	..	11 7	17 6
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 13*	10 13*	10 13*	10 13*	10 4
Calcium cyanamide (N. 19%) ..	8 18‡	8 18‡	8 18‡	8 18‡	9 4
Kainit (Pot. 14%)..	3 7	2 17	3 0	3 1	4 4
Potash salts (Pot. 30%)	5 2	..	..	4 19	3 4
,, (Pot. 20%)	3 17	3 5	3 10	3 10	3 6
Muriate of potash (Pot. 50-53½%)	9 10	8 15	9 9	10 0	3 9
Sulphate ,, ,, (Pot. 48-51¼%)	11 10	10 15	11 14	12 2	4 9
Basic Slag (T.P. 34%)	3 6§	2 12§	2 12§	..	..
,, (T.P. 32%)	3 3§	2 10§	2 10§	.	..
,, (T.P. 30%)	3 1§	2 7§	2 7§	2 15*e*	1 10
,, (T.P. 24%)	2 7§	1 18§	1 19§	..	..
Ground rock phosphate (T.P.58%)					
Very fine grade¶	2 15	..	..	2 10*d*	0 10
Fine grade‖	2 10	2 10	..	2 7*d*	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 4	3 0	1 9
,, (S.P. 33%) ..	..	..	3 2	..	..
,, (S.P. 30%) ..	2 15	2 12	2 18	2 15	1 10
Bone meal (N. 3¾%, T.P. 45%) ..	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ¾%, T.P. 60-65%)	5 17†	6 2†	6 5	5 15	..
Burnt Lump Lime	1 9	1 12*a*	1 16*b*	2 1§	..
Ground Lime	1 18	2 1*a*	2 6*b*	1 15§	..
,, Limestone	..	..	1 10*b*	..	..
,, Chalk	..	1 9	..	1 5§	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ Delivered in 4-ton lots at purchaser's nearest railway station.

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

‖ Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull. *b* Delivered to Liverpool area.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.E. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.o.r. Northern rails; 3s. 6d. per ton extra on Southern rails.

NOTES ON FEEDING STUFFS FOR MARCH

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The Fibre in the Ration.—Fibre has been referred to as the "fill-belly" of the ruminant. It is something more than that, however, as will presently be seen. Its functions in the plant are two-fold. Firstly, it is the material from which is constructed the wall or envelope of each tiny plant cell. Secondly, it serves the plant in the later stages of growth in much the same way as the skeletal structure is of service to the animal, in that it confers a certain rigidity on the grown-up plant, enabling a stout resistance to be offered to the onslaught of wind and storm. Curiously enough, although fibre is abundantly consumed by animals, it does not enter into the composition of the animal body. Fibre is an essential part of the structure of the plant cell, but not of the animal cell.

The isolation of fibre from feeding stuffs by chemical means is a simple matter, involving the boiling up of the food first with dilute sulphuric acid and then with dilute soda. This treatment dissolves out the protein, oil, starchy matter ("soluble carbohydrates") and soluble ash, the undissolved residue being therefore composed of fibre mixed with a little sand. It was at one time thought that this residue was a measure of the amount of indigestible material in the food. This, however, is now known to be by no means the case.

What is the chemical nature of the fibre so obtained? To answer this question it will be necessary to inquire first of all into the nature of the changes which occur in the plant as is grows and develops in the direction of maturity. In the young plant, the cell walls are extremely thin and tender and are composed entirely of a substance called cellulose. This substance belongs to the class of insoluble carbohydrates, and in chemical nature is related to starch. It is encountered in a fairly pure form in good samples of blotting paper. It will be shown later that the ruminant animal is able to digest this form of fibre almost as readily and efficiently as it is able to digest starch. As the plant advances in maturity, the cell walls undergo thickening, a process commonly referred to as lignification. The originally thin cell walls of cellulose become surrounded and intimately admixed with sand and highly carbonaceous forms of fibre known as ligno-celluloses. These so-called "incrusting substances" are entirely indigestible. The greater the proportion of ligno-cellulose in the plant, the more nearly does the fibre approach the nature of wood.

It is clear, therefore, that one of the characteristic changes in the growing plant is a gradual diminution in the digestibility of its fibrous constituent. Obviously, the plant is catering primarily for its own requirements rather than for those of animals. Thus, it has been shown at Cambridge that the fibre in young pasture grass is digested by ruminants to the extent of more than 80 per cent., a degree of digestibility comparing favourably with that associated with the soluble carbohydrates. The much woodier fibre of hay, on the other hand, is digested only to the extent of about 50 per cent.

This, however, does not comprise the whole story. Unless the fibrous envelope of the plant cells is capable of being easily dissolved away during digestion, it may be that the food nutrients like oil, protein and carbohydrate contained within the cells will not be readily accessible to the digestive ferments during the passage of the food along the alimentary canal. Under such conditions, the nutrients of the food may only be utilized to a poor extent by the animal. Thus, although there is no reason to suppose that the protein constituents of young pasture grass and of hay are intrinsically different in chemical nature, it has been shown that the protein of young pasture herbage is more than 80 per cent. digestible (*i.e.*, as digestible as the protein of linseed cake), whereas the protein in hay, on account of the less digestible character of the fibrous cell walls, is only utilized to the extent of about 55 per cent.

The foregoing considerations afford a basis for understanding the principles underlying the process which has been patented recently on the Continent for "pulping out" the nutrient food from the cells of green crops like grass and lucerne, and separating it from the fibrous cell-wall material. The fibre-free "plasma-pulp" is then moulded into cakes and dried for use in winter feeding. Obviously, however, such an expensive process could be dispensed with in the case of young grass, or any other immature green crop, since the fibre in such fodders is easily and almost wholly digestible in the ruminant organism, and cannot therefore hinder the ready digestion and assimilation of the other food nutrients present in the cells. In the case of the pig, however, which cannot deal with fibre so efficiently as the ruminant, the "Ereky" process undoubtedly offers attractive possibilities.

Straw is one of our most lignified feeding stuffs. Its cellulose constituent is rendered in a large measure unavailable to the animal by being embedded in large amounts of silica and ligno-cellulose. During the war, the German scientist turned

his attention to the problem of discovering a simple method whereby the cellulose of the straw could be liberated from the incrusting materials and thereby be rendered available as a food nutrient to the ruminant animal. This was found possible by treatment of the straw, under quite simple conditions, with dilute solutions of caustic soda, washing soda or quicklime. By such methods, the digestibility and nutritive value of the straw could be enhanced very considerably. With the passing of war-time conditions, however, the results of these striking Continental investigations appear to have aroused but small interest in this country.

The question arises as to the value which must be assigned to the digestible portion of the fibre of a food in the nutrition of the ruminant animal. This question has been answered by Kellner, who, in the series of investigations which led to the formulation of his system of starch equivalents, tested the value, in the rations of fattening oxen, of a feeding stuff rich in digestible fibre (namely, rye straw which had been boiled under pressure with an alkaline solution to free the cellulose from incrusting substances). He demonstrated that 1 lb. of digestible fibre is equal to the same weight of starch for purposes of fattening. This discovery is given practical recognition in his well-known expression for calculating the production starch equivalent of a feeding stuff.

By what means is the farm animal able to digest and utilize the very stable cellulose constituent? Digestion of food is usually associated with the action of enzymes or ferments secreted into the alimentary tract in the various digestive juices. Up to the present, however, investigation has failed to reveal the presence of any cellulose-digesting ferment in the digestive tract of the higher animals, although such a ferment of great activity is known to occur in the intestinal secretion of the snail. The digestion of cellulose in the ruminant animal is brought about by the intervention of certain micro-organisms known as cellulose-splitting bacteria, which have their chief seat of activity in the first stomach of the animal. These micro-organisms can be isolated in pure culture and made to work in artificial media. Laboratory investigations have shown that they split up filter paper and other forms of cellulose into organic acids like acetic and butyric acids, together with gases like hydrogen, carbon dioxide and marsh gas. Such cultures of bacteria are now employed for the production of marsh gas on a commercial scale from fibrous products like cotton waste.

The text-book theory of cellulose digestion assumes, therefore, that the digestible fibre in the animal's ration is digested by being broken down by bacteria in the rumen to organic acids of the acetic and butyric acid type, and to gases like marsh gas and carbon dioxide. Such a theory, however, comes into direct conflict with Kellner's experimentally demonstrated fact that digestible fibre and starch possess equal values for fattening in the ruminant, since manifestly the digestion products of cellulose, if this theory be correct, cannot have the same value to the animal as the glucose sugar derived from the digestion of starch. Indeed, the gaseous products, marsh gas and carbon dioxide, are excreted as waste products from the body of the animal.

The writer's attention was directed to this discrepancy between experiment and theory when he was considering the significance of the high digestion co-efficients which were being obtained for the fibre in young pasture grass during the carrying out of the Cambridge grass land investigations. He was led thereby to make a critical study of the evidence on which the text-book theory of cellulose digestion is based. It would, however, require too much space to summarize the various points which were considered, and the reader who may be interested in this subject is referred to the original paper dealing with the question.* Evidence was adduced in this paper to show that the bacterial digestion of a given weight of digestible fibre in the ruminant tract gives rise to as much glucose sugar as is formed by the enzymic digestion of an equal weight of starch. In the form of glucose, therefore, both starch and cellulose are ultimately absorbed into the blood stream of the animal, a view which is in entire harmony with Kellner's finding as to the value of digestible fibre in the diet of the ruminant animal.

* * * * * *

* H. E. Woodman: "The Mechanism of Cellulose Digestion in the Ruminant Organism," *Jour. Agric. Sci.*, Vol. XVII, 1927.

DESCRIPTION	Price per qr. s. d.	lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	10 5	0 13	9 12	72	2 8	1·43	9·6
Barley, British feeding	—	—	10 0	0 10	9 10	71	2 8	1·43	6·2
„ Canadian No. 3 Western	40 0	400	11 3	0 10	10 13	71	3 0	1·61	6·2
„ American	39 6	„	11 2*	0 10	10 12	71	3 0	1·61	6·2
„ Persian	38 0	„	10 13	0 10	10 3	71	2 10	1·52	6·2
„ Russian	39 6	„	11 2	0 10	10 12	71	3 0	1·61	6·2
Oats, English, white	—	—	10 13	0 11	10 2	60	3 4	1·78	7·6
„ „ black and grey	—	—	10 7	0 11	9 16	60	3 3	1·74	7·6
„ Irish, white	—	—	11 0	0 11	10 9	60	3 6	1·87	7·6
„ „ black	—	—	10 0	0 11	9 9	60	3 2	1·70	7·6
„ Canadian No. 2 Western	36 3	320	12 13*	0 11	12 2	60	4 0	2·14	7.6
„ Argentine	28 9	„	10 2	0 11	9 11	60	3 2	1·70	7·6
„ Russian	31 6	„	11 0†	0 11	10 9	60	3 6	1·87	7·6
Maize, Argentine	42 0	480	9 17	0 11	9 6	81	2 4	1·25	6·8
Beans, English, winter	—	—	9 2†	1 6	7 16	66	2 4	1·25	20
Peas, English, blue	—	—	15 15†	1 3	14 12	69	4 3	2·28	18
„ Japanese	—	—	23 5§	1 3	22 2	69	6 5	3·44	18
Dari, Palestine	—	—	11 5	0 13	10 12	74	2 10	1·52	7·2
„ Persian	—	—	10 10	0 13	9 17	74	2 8	1·43	7·2
Millers' offals—									
Bran, British	—	—	8 12	1 3	7 9	42	3 7	1·92	10
„ broad	—	—	9 15	1 3	8 12	42	4 3	2·28	10
Middlings, fine, imported	—	—	10 15	0 18	9 17	69	2 10	1·52	12
„ coarse, British	—	—	9 0	0 18	8 2	58	2 10	1·52	11
Pollards, imported	—	—	8 7	1 3	7 4	60	2 5	1·29	11
Meal, barley	—	—	12 2	0 10	11 12	71	3 3	1·74	6·2
„ maize	—	—	10 7	0 11	9 16	81	2 5	1·29	6·8
„ „ S. African	—	—	9 15	0 11	9 4	81	2 3	1·20	6·8
„ „ germ	—	—	10 5	0 16	9 9	85	2 3	1·20	10
„ „ gluten feed	—	—	10 7	1 1	9 6	76	2 5	1·29	19
„ locust bean	—	—	9 0	0 8	8 12	71	2 5	1·29	3·6
„ bean	—	—	12 15	1 6	11 9	66	3 6	1·87	20
„ fish	—	—	21 10	3 10	18 0	53	6 10	3·67	48
Maize, cooked flaked	—	—	12 0	0 11	11 9	85	2 8	1·43	8·6
Linseed—									
„ cake, English 12% oil	—	—	13 0	1 11	11 9	74	3 1	1·65	25
„ „ „ 10% „	—	—	12 10	1 11	10 19	74	3 0	1·61	25
„ „ „ 9% „	—	—	12 5	1 11	10 14	74	2 11	1·56	25
Soya bean „ „ 6% „	—	—	11 10	2 4	9 6	69	2 8	1·43	36
Cottonseed cake „ 5½% „	—	—	8 12	1 10	7 2	42	3 5	1·83	17
„ „ Egyptian, 5½% „	—	—	8 5	1 10	6 15	42	3 3	1·74	17
Decorticated cottonseed meal, 7% oil	—	—	12 10§	2 5	10 5	74	2 9	1·47	35
Ground-nut cake, 7% oil	—	—	10 7*	1 7	9 0	57	3 2	1·70	27
Decorticated ground-nut cake, 7% oil	—	—	13 5*	2 5	11 0	73	3 0	1·61	41
Palm kernel cake, 6% oil	—	—	8 12§	0 19	7 13	75	2 0	1·07	17
„ „ „ meal, 6% oil	—	—	10 5†	0 19	9 6	75	2 6	1·34	17
„ „ meal 2% „	—	—	9 10†	1 0	8 10	71	2 5	1·29	17
Feeding treacle	—	—	6 0	0 9	5 11	51	2 2	1·16	2·7
Brewers' grains, dried ale	—	—	8 15	1 0	7 15	49	3 2	1·70	13
„ „ „ porter	—	—	8 5	1 0	7 5	49	3 0	1·61	13
„ „ wet ale	—	—	1 15	0 7	1 8	15	1 10	0·98	4·8
„ „ „ porter	—	—	1 0	0 7	0 13	15	0 10	0·45	4.8
Malt culms	—	—	8 10§	1 9	7 1	43	3 3	1·74	16

* At Bristol. § At Liverpool. † At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of January, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·29d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P_2O_5, 8s. 10d.; K_2O, 3s 3d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations, are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	11 0
Maize	81	6·8	9 17
Decorticated ground nut cake	73	41·0	13 5
„ cotton cake	71	34·0	11 5

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 2·74 shillings, and per unit protein equivalent, 1·54 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1927, issue of the Ministry's JOURNAL.)

FARM VALUES.

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	10 12
Oats	60	7·6	8 16
Barley	71	6·2	10 4
Potatoes	18	0·6	2 10
Swedes	7	0·7	1 0
Mangolds	7	0·4	1 0
Beans	66	20·0	10 12
Good meadow hay	31	4·6	4 12
Good oat straw	17	0·9	2 8
Good clover hay	32	7·0	4 18
Vetch and oat silage	13	1·6	1 18
Barley straw	19	0·7	2 13
Wheat straw	11	0·1	1 10
Bean straw	19	1·7	2 15

* * * * * *

MISCELLANEOUS NOTES

Danish Experiments with Beet Hoes

IN Denmark a considerable part of the cultivated farming area—about one-fifth—is devoted to the cultivation of root crops, and the whole of this area is weeded by means of beet hoes. The result has been that a number of new patterns have been introduced for the cleaning of root crops. Some of these implements have already been subjected to trials and experiments, but, at the desire of several agricultural organizations, the State Commission for Experiments with Farming Implements has decided to conduct comparative experiments with hoes during the spring and summer of 1928. The trial may comprise both Danish and foreign beet hoes for one, two, or more rows. It is to be carried out on both light and heavy soils, and the implements tested will be for the weeding of sugar beet, turnips, etc.

Further particulars as to these trials may be obtained on application to the Office of the State Commission for Experiments with Farming Implements, 40 Bülowsvej, Copenhagen V, Denmark.

* * * * * *

Young Farmers' Clubs : Dairy Cattle Judging Competition

THE Annual Dairy Cattle-Judging Competition for members of Young Farmers' Clubs in England and Wales, postponed owing to Foot-and-Mouth Disease from the Dairy Show last October, took place by courtesy of the Northants Education Committee at the County Farm Institute, Moulton, Northants, and neighbouring farms on January 26, 1928. Keen interest was shown in the contest.

A Silver Challenge Cup, presented by the *Farmer and Stock-Breeder and Agricultural Gazette*, for the champion team, and silver and bronze medals awarded by the British Dairy Farmers' Association for the three individual competitors obtaining the highest marks, were competed for, and a further stimulus was that the winners of this contest would meet the champion cattle-judging team from the 4-H (or Young Farmers') Clubs of America in the Annual International Contest to be held in this country next summer.

The classes of cattle judged comprised Friesian, Shorthorn and Jersey Dairy Cows with four animals in each class. Each

team consisted of three "young farmers," and four clubs entered teams. The competitors were allowed 12 minutes in which to decide the correct order of placing the animals in each group, points up to a maximum of 50 being awarded to each competitor for "placing." A further 50 points were obtainable for giving reasons in support of the order of placing.

The Sussex Baby Beef Club, the winners last year and the year before, were again successful in holding the Cup by a margin of 12 points over the second team, the Bletchley Calf Club. The Buckingham Royal Latin School Calf Club took third place, and the Buckland Calf Club were a good fourth. The scores were as follows (maximum 900) :—

Sussex Baby Beef Club	670
Bletchley Calf Club	658
Buckingham Royal Latin School Calf Club ..	562
Buckland Calf Club	552

It is notable that the first four places in the individual scoring were occupied by girls, the names and scores being as follows :—

Edith Harriott (Sussex Baby Beef Club)	243	(Silver Medal)
Constance North (Bletchley Calf Club)	241	(Bronze Medal)
Mary Beavington (Bletchley Calf Club)	224	(Bronze Medal)
Mabel Harriott (Sussex Baby Beef Club)	223	

Edith Harriott has secured the Silver Medal of the British Dairy Farmers' Association for the third time.

The judges were Mr. J. Mackintosh, of Reading, and Mr. J. S. Shirley, of Bletchley.

* * * * * *

The Agricultural Index Number

THE general index figure for agricultural produce in January was 45 per cent. above the base years 1911-13, a rise of 7 points as compared with the figure for the previous month. The index figure was raised to some extent by the higher prices ruling for fat cattle, sheep and pigs, but normally a rise of several points occurs at this period of the year owing to the fact that prices in January, 1911-13,

were generally lower than in December, and the percentage increase above the base is, therefore, greater.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911–13					
	1923	1924	1925	1926	1927	1928
January	67	60	71	58	49	45
February	63	61	69	53	45	—
March	59	57	66	49	43	—
April	54	53	59	52	43	—
May	54	57	57	50	42	—
June	49	56	53	48	41	—
July	50	53	49	48	42	—
August..	52	57	54	49	42	—
September	52	61	55	55	43	—
October	50	66	53	48	40	—
November	51	66	54	48	37	—
December	55	65	54	46	38	—

Grain.—Wheat and barley were unaltered in price at averages of 9s. 10d. and 11s. 2d. per cwt., respectively, but oats at 9s. 6d. showed a rise of 4d. per cwt. The index figure for wheat remained at 34 per cent. above pre-war, as compared with 61 per cent. in the preceding January, and barley and oats were 5 and 8 points higher on the month at 40 and 39 per cent., respectively, against 36 and 20 per cent. a year ago.

Live Stock.—The stringent movement restrictions on account of foot-and-mouth disease which were in force during January, and the severe weather which prevailed in the early part of the month curtailed the entries of live stock, and in many cases higher prices were realized for the small supplies which were marketed. The average for second quality fat cattle advanced by about 2s. per live cwt., and fat sheep were dearer by about ¾d. per lb., estimated dressed carcass weight, the index figure for the former advancing 12 points to 28 per cent. above 1911-13, and the latter by 19 points to 63 per cent. Fat pigs, both baconers and porkers, showed an increase in price, and this fact, in conjunction with the lower base prices in January, 1911-13, caused the index numbers to show a sharp rise. Store cattle, sheep and pigs were a little dearer, and in each case the relative index figure was higher, while dairy cows were cheaper at 26 per cent. above pre-war.

Dairy and Poultry Produce.—Milk prices were unaltered on the month, and the index figure was unchanged at 66 per cent. above 1911-13, and practically the same as in January, 1927 ;

butter also remained steady at 47 per cent. dearer than pre-war. A slight decline in cheese prices was accompanied by a lower base price, and the index number rose by 6 points to 61 per cent. above pre-war. Poultry were cheaper than in the preceding month, but as this was the customary movement in prices, and the changes were very similar to those in 1911-13, the index figure was little altered at 38 per cent. above pre-war. In the case of eggs, the slight fall in price was much less than in the period December to January, 1911-13, and the rise of 36 points to 77 per cent. above the level of the base years is due to this factor.

Other Commodities.—Hay prices were unaltered on the month, but the index number declined from 20 to 18 per cent. above pre-war owing to the effect of higher base prices, and this cause nullified also the effect of a rise in potato prices in January, potatoes averaging 74 per cent. above pre-war as against 75 per cent. in December. Wool was slightly dearer during the month under review, and the index figure 8 points higher at 58 per cent. above the base years 1911-13.

Index numbers of different commodities during recent months and in January, 1926 and 1927, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13

Commodity	1926	1927					1928
	Jan.	Jan.	Sept.	Oct.	Nov.	Dec.	Jan.
Wheat	67	61	48	42	34	34	34
Barley	31	36	62	62	45	35	40
Oats	35	20	35	33	30	31	39
Fat cattle	52	33	30	23	19	16	28
Fat sheep	63	57	45	41	40	44	63
Bacon pigs ..	94	70	34	22	18	20	34
Pork pigs	94	82	41	35	29	33	44
Dairy cows ..	42	28	28	27	28	28	26
Store cattle ..	33	29	24	19	13	13	24
Store sheep ..	57	55	49	40	35	35	42
Store pigs	121	135	64	56	44	41	47
Eggs	70	46	54	66	47	41	77
Poultry	56	38	37	43	46	37	38
Milk	74	65	65	57	59	66	66
Butter	53	37	41	41	47	47	47
Cheese	82	38	59	56	55	55	61
Potatoes	53	95	46	72	76	75	74
Hay	4	−1*	18	18	19	20	18
Wool	50	32	43	43	46	50	58

* Decrease.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended December, 1927, compared with the corresponding period in 1926. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	Oct. to Dec., 1927		Oct. to Dec., 1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	46	6,570	57	6,204
Belgium	28	508	0	0
Brazil	12	1,400	30	3,692
Colombia	10	1,584	1	200
Cuba	0	0	26	865
Guatemala	0	0	10	335
Kenya	19	682	3	167
Palestine	0	0	4	1.500
Uruguay	4	750	4	235
British India	5	185	8	390
Canada	75	5,520	0	0
Irish Free State	756	11,905	1,321	20,060
Other countries	22	1,572	20	893
Total	977	30,676	1,484	34,541
SHEEP AND LAMBS				
Argentina	379	9,710	329	9,963
Brazil	43	1,215	40	1,210
Chile	47	1,670	7	1,200
Kenya	8	190	0	0
Russia	0	0	266	3,803
Uruguay	73	1,196	85	2,268
United States of America	96	1,183	0	0
Canada	63	1,540	0	0
Irish Free State	201	1,204	1,112	2,346
Other countries	22	257	18	292
Total	932	18,165	1,857	21,082
SWINE				
Argentina	3	46	7	260
Germany	4	220	5	115
Japan	8	428	3	113
Kenya	1	50	7	150
Lithuania	0	0	24	1,200
Poland	13	340	0	0
Irish Free State	234	387	327	1,949
Other countries	16	315	18	712
Total	279	1,786	391	4,499

Export of Breeding Stock in 1927

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland during 1927, with comparative figures for 1926. (From *Annual Statement of Trade*, and returns supplied by H.M. Customs and Excise.)

Country to which exported	1927		1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	346	104,420	337	51,329
Belgium	92	2,015	0	0
Brazil	26	4,185	110	10,330
Chile	4	1,090	34	3,355
Kenya	39	1,975	18	1,204
Uruguay	62	12,186	57	10,991
Australia	46	6,943	35	6,421
Canada	209	15,820	0	0
Irish Free State ..	4,536	76,068	5,708	84,544
Union of South Africa ..	45	3,839	20	1,150
Other countries	146	9,110	182	9,884
Total	5,551	237,651	6,501	179,208
SHEEP AND LAMBS				
Argentina	878	21,098	629	18,011
Brazil	56	1,861	49	1,452
Chile	65	2,500	14	1,403
Peru	89	1,143	0	0
Russia	0	0	266	3,803
Uruguay	133	3,136	166	5,079
United States of America	155	2,235	0	0
Canada	389	6,730	0	0
Irish Free State	1,575	4,999	2,038	4,478
Other countries	221	3,212	99	1,764
Total	3,561	46,914	3,261	35,990
SWINE				
Argentina	19	571	23	627
France	44	686	19	425
Germany	30	941	30	843
Japan	18	1,064	3	113
Poland	21	690	5	265
Russia	0	0	180	3,646
Serb-Croat-Slovene State	0	0	40	1,250
Irish Free State ..	1,287	3,741	1,123	6,155
Other countries	93	1,762	110	3,570
Total	1,512	9,455	1,533	16,894

Trials of Potatoes for Immunity from Wart Disease, 1927

THE trials which are arranged each year by the Ministry with the object of testing new varieties of potatoes as to their immunity from Wart Disease, were again conducted in 1927 on the farm of the National Institute of Agricultural Botany, Ormskirk, Lancashire. The actual field operations and the taking of records were carried out by Mr. Harold Bryan, B.Sc., and Mrs. McDermott, of the Institute, but the trials were conducted on a plan approved by the Ministry.

The weather conditions were ideal for planting, and little rain fell during the first eight weeks of growth. This dry spell was accompanied by continuous cold winds, and because of these conditions Wart Disease was late in appearing, not being observed in the field until July 8. During the greater part of the growing season, however, rain fell heavily and continuously, and after the first appearance of disease all the susceptible varieties rapidly became infected. The season was accordingly a very reliable one for test purposes, as critical examination of the whole of the control plots showed 100 per cent. infection. The wet season induced rapid rotting of the actual wart, and by the end of September it was difficult to obtain fresh specimens of the disease. It was noted that tubers infected with Wart Disease showed greater liability to rot in the ground than did uninfected tubers from the same plant.

Twenty-eight stocks were included in the second and third-year tests, and of these three proved susceptible to Wart Disease. Of the 57 entries for the first-year tests, 17 became infected; 18 proved to be synonyms of existing varieties; 4 were too mixed to judge; 2 were duplicates of another seedling; 30 were distinct varieties, and 3 foreign varieties were true to name.

The results of the trials have been considered by a small committee composed of representatives of the Ministry of Agriculture and Fisheries, the Board of Agriculture for Scotland, and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials carried out by the two latter Departments at Philpstoun and Kilkeel respectively.

The Committee recommended the approval of 27 new varieties, but only nine of these have actually been added to the approved list. In the remaining cases inclusion has been postponed until such time as the raisers have intimated that the varieties have actually been, or will shortly be, introduced

into commerce. Descriptions are given below of the nine new varieties, together with those of four varieties which are already on the market and are known to be immune, and one variety which was approved as the result of the 1923 trials, but which is only now being introduced into commerce.

The findings of the Potato Synonym Committee of the National Institute of Agricultural Botany have been accepted by the Ministry where recommendations as to the classification of new varieties as synonymous with existing varieties have been made by that Committee.

Second Early Varieties :—

"*Clovullin.*"

Sprout ..	Blue.
Tuber ..	Oval, frequently tapering towards the heel; skin white; flesh lemon; eyes shallow.
Haulm and Foliage	Open, spreading, only moderately vigorous; leaflets dark grey-green, soft appearance, dull, rather broad and short, drooping; stems numerous, pink coloration at the base only; wings straight.
Flowers ..	None observed.

"*Cluny.*"

Sprout ..	Blue.
Tuber ..	Round; skin blue-purple; flesh white with a ring of blue; eyes shallow, open, saucer-shaped.
Haulm and Foliage	Tall, upright; stems blue-purple, wings waved at the tops; leaf open, mid-rib blue-purple, dark red at the base; leaflets medium green, large, heart-shaped at the base; top leaflets narrow, terminal leaflet sometimes tied; secondary leaflets small, fairly numerous.
Flowers ..	White, large; stalks short; buds pink-green.

"*Scale's Pride.*"

Sprout ..	Blue.
Tuber ..	Kidney, frequently tapering at the heel; skin white; flesh white; eyes shallow.
Haulm and Foliage	Open, moderately vigorous, upright to spreading; leaflets dark green, long, broad and wrinkled; slight general pink coloration of the stems; wings straight; secondary leaflets numerous.
Flowers ..	White, borne on long stalks; anthers orange.

Late or Maincrop Varieties :—

"*Early Templar.*"

Sprout ..	Blue.
Tuber ..	Oval to oblong; skin white; flesh white; eyes shallow and on the point, eyebrows long.
Haulm and Foliage	Tall, upright, dense; stems mottled blue-purple and having many thin branches; leaf open, broad; leaflet ashy green, dull, smooth; large pair of secondary leaflets below the terminal pair of lateral leaflets.
Flowers ..	White, frequent, anthers malformed; buds green-purple.

"*Electron.*"

Sprout ..	Pink.
Tuber ..	Oval, frequently tapering towards the heel, irregular; skin white; flesh white; eyes shallow.
Haulm and Foliage	Tall, upright to spreading, moderately vigorous; leaflets yellowish-green, narrow, fairly short, dull appearance, erect; leaf open; stems green, numerous; wings straight; secondary leaflets small.
Flowers ..	White, small, not numerous.

"*Glen Ericht.*"

Sprout ..	Faint pink.
Tuber ..	Oval, somewhat pointed; skin white; flesh white; eyes shallow to medium, ridged.
Haulm and Foliage	Medium height, spreading; leaf flat, open; mid-ribs of young leaves have a pink tinge; leaflets flat, ashy green, smooth, pointed.
Flowers ..	Not formed; buds pink.

"*Gregor Cups.*"

Sprout ..	Pink.
Tuber ..	Round, dented at heel; skin pink; flesh white; eyes deep.
Haulm and Foliage	Tall, coarse, open; stem strong and branching freely, mottled red-purple; wings markedly waved; leaf rigid, short; midrib red-purple, especially in younger leaflets; leaflets medium to dark green, wrinkled, often with mosaic appearance, edges waved.
Flowers ..	White, with green tips, very rare; buds dark, dropping readily.

"*Harcarse Red.*"

Sprout ..	Deep pink.
Tuber ..	Round; skin deep pink; flesh lemon; eyes shallow.
Haulm and Foliage	Open, upright, only moderately vigorous; leaflets grey-green, hard glossy appearance, wrinkled, narrow, short, erect, fluted; leaf open; secondary leaflets small; stems deeply bronzed, coloration extending to the mid-ribs of the leaves and leaflets.
Flowers ..	White, frequently malformed; anthers orange.

"*Inverness Favourite.*"

Sprout ..	Purple.
Tuber ..	Oval; skin white; flesh pale lemon; eyes shallow.
Haulm and Foliage	Upright, bushy; leaflets dark grey-green, dull, medium size, involute; stems bronzed; wings much serrated.
Flowers ..	White, large, rare.

"*Lord Tennyson.*"

Sprout ..	Blue.
Tuber ..	Round; skin blue, mottled yellow; flesh pale yellow; eyes shallow.
Haulm and Foliage	Tall and upright; stems mottled blue-purple, branching; leaf open, mid-rib blue-purple at end bases of leaf stalks, leaf short; leaflet medium green, glossy, small.

Flowers ..	Blue-purple, tipped white; frequent; flower stalks short; buds pink-purple.

"Medland."

Sprout ..	Pink.
Tuber ..	Round; skin white, flecked pink, especially in the eyes and at the rose end; flesh lemon; eyes shallow.
Haulm and Foliage	Open, upright, spreading later, moderately vigorous; leaflets light grey-green, small, short, narrow, erect; secondary leaflets small and few; stems general pink coloration; wings straight.
Flowers ..	White, stigma bifed; anthers orange.

"Sharp's Pink Seedling."

Sprout ..	Pink.
Tuber ..	Round; skin pink; flesh white; eyes shallow.
Haulm and Foliage	Medium to tall; stems numerous, tinged red-purple, especially at base; leaf open, rigid, mid-rib dark red; leaflets round, distinctly pointed, medium green, dull; secondary leaflets small, but often numerous, projecting upwards.
Flowers ..	Red-purple, tipped white, profuse; buds dark; stalks long.

"The Cherry."

Sprout ..	Pink.
Tuber ..	Oval; skin white; flesh white; eyes shallow.
Haulm and Foliage	Tall, strong, upright, compact; leaflets yellowish-green, broad, roundish, wrinkled, harsh and dull appearance; secondary leaflets large and numerous; leaf close; stems green with slight coloration in axils; wings straight with occasional slight serration.
Flowers ..	White, numerous; anthers orange; berries form freely.

"The Craigie."

Sprout ..	Pink.
Tuber ..	Kidney; skin white; flesh white; eyes shallow.
Haulm and Foliage	Tall, strong, upright, compact; leaflets light grey-green, short, narrow, wrinkled, harsh appearance; secondary leaflets not numerous; leaf close; stems green; wings straight.
Flowers ..	White, small.

* * * * * *

Wart Disease Immunity Trials, 1928

THE Ministry will continue during the coming season to test, at the Potato Testing Station of the National Institute of Agricultural Botany, Ormskirk, potatoes and potato seedlings as to their immunity from or susceptibility to wart disease on the conditions stated below.

The entry form (No. 345 H.D.), obtainable from the Ministry, must be filled up and returned to the Potato Testing Station, Lathom, Ormskirk, Lancs, *with the*

requisite fees. Samples must be sent to the Station so as to arrive *not later than March* 31, 1928.

Potatoes are accepted *from English, Scottish, and Irish growers* for trial under the following conditions :—

(*a*) Quantity of each stock of Potato to be sent for the first time —35 seed size tubers.

Quantity of each stock of Potato to be sent for the second and for subsequent years—50 seed size tubers.

(*b*) Fees on the following scale are payable in respect of each stock of Potato when first entered for immunity trials :—

Less than 5 samples from one grower	10s. per sample.
5 samples or more from one grower	8s. per sample up to 20, and 6s. for each sample in excess of 20.

These fees are not returnable under any circumstances.

(*c*) The Ministry, while taking reasonable precautions to secure satisfactory growth, can accept no responsibility for the failure of any variety.

(*d*) The Ministry will take all reasonable precautions to secure that all the produce of the trial plots is fed to stock after being thoroughly mixed together, except such portions as may be needed for exhibition or scientific purposes authorized by the Ministry. The Ministry, however, reserves the right to send tubers from the produce grown at Ormskirk for testing at the official stations of the Board of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland.

(*e*) The Ministry will furnish as early as possible a report on each stock forwarded.

(*f*) When the Ministry is satisfied, as a result of the trials, that a variety is immune from Wart Disease, it will formally "approve" the variety and will issue an official certificate of immunity. Such certificates will not be issued until the variety has been named, and until an assurance has been received from the sender that it has been, or is about to be, introduced into commerce. *When a variety tested under a number or letter has been subsequently named and "approved," a sample of* 100 *tubers of the variety as named must be sent to Ormskirk for comparison with the tested stock.* No certificate will be issued for any new variety until it has passed at least two consecutive years' tests without contracting the disease, and has been declared by the Synonym Committee of the National Institute of Agricultural Botany to be distinct from existing varieties.

Potatoes are accepted from foreign growers on the conditions (*a*) to (*e*) set out above, but no foreign variety will be formally "approved" and no certificate will be issued until the variety is definitely introduced into commerce in Great Britain.

Trials of Seedlings.—The Ministry desires to encourage the breeding of new varieties of potatoes, and in order to provide information for breeders of seedlings it is prepared to accept not fewer than two tubers and not more than 10 tubers of any seedlings for growing for one season on the trial plots, and to furnish a report on the results obtained without payment of a fee. These tests, however, will not be considered as forming

part of the Immunity Trials proper, and will not be reckoned in the minimum period of two years referred to under (*f*). The results of these tests will not be included in any report issued by the Ministry.

GENERAL INSTRUCTIONS : *Carriage.*—Small consignments should be sent by passenger train, carriage paid, or by parcel post ; larger consignments should be forwarded by goods train, carriage paid.

Labels.—All consignments should be distinctly labelled. A label bearing the name and address of the sender and name of variety or seedling number should be firmly tied to the bag ; in addition a similar label should be placed inside the bag.

Address.—All consignments should be addressed to :—

THE SUPERINTENDENT,
POTATO TESTING STATION,
NATIONAL INSTITUTE OF AGRICULTURAL BOTANY,
Lathom, ORMSKIRK, Lancs.

Station : Ormskirk, L.M. & S. Railway.

Date of Forwarding.—Consignments should be sent so as to reach the Testing Station not later than March 31.

* * * * * *

Displays of Home Produce

AT the British Industries Fair, held at the White City from February 20 to March 2, and at the Ideal Home Exhibition, staged at Olympia from February 28 to March 24, the Empire Marketing Board arranged exhibits of Empire produce on a large scale. Very generous allocations of space were made for home produce. The Ministry, in collaboration with the National Farmers' Union, and the other organizations who customarily assist, organized the Great Britain sections, and displays worthy of the Home Country were staged in each case.

The majority of the visitors to the Fair come from overseas, and special attention was given, therefore, to those commodities which have a potential export value, such as wool, seed potatoes, and pedigree live stock. The Board of Agriculture for Scotland arranged for a representative exhibit of wool and also of seed potatoes from that country, and these were shown side by side with fleeces and potatoes from England. The Ministry provided three "Textophote" machines, which showed, in rotation, illuminated photographs of practically every British breed of horses, cattle, sheep and pigs. For this feature, the Ministry sought the assistance of the various Breed Societies, most of whom supplied the necessary photographs. An attractive display of home-produced bacon, dairy produce, eggs, glass-house produce, beet sugar, cereal products, vegetables and fruit—bottled, canned, and cider—was provided on the Stand as usual.

At the Ideal Home Exhibition, where the appeal is to the ordinary housewife rather than to the trade buyer, a number of new effects have been incorporated in the Great Britain section in order to attract attention to home produce. A full description, together with photographs, will appear in the next issue of this JOURNAL.

* * * * * *

Production of Home-grown Beet Sugar

ACCORDING to returns rendered to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during January, 1928, together with the quantity produced during the corresponding month in 1927, was :—

January, 1928	473,854 cwt.
January, 1927	606,924 ,,

The total quantities of sugar produced during the two manufacturing campaigns to the end of January were :—

1927-1928	3,789,814 cwt.
1926-1927	2,982,227 ,,

* * * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on February 6, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding. The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying out the Committees' decisions :—

Northumberland.—An Order continuing from May 13, 1928, until May 13, 1929, the minimum and overtime rates of wages at present in force for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are—for stewards, horsemen, cattlemen, stockmen and shepherds who are householders 39s., and for such workers who are not householders 36s. per week of 62 hours, and for other male workers (except casual workers) 32s. per week of 48 hours in winter and 52½ hours in summer, with overtime in all cases at one and a-quarter times the general minimum time rate on weekdays, and one and a-half times the general minimum time rate on Sundays. The minimum rate for casual workers of 18 years of age and over is 7½d. per hour for all time worked. The minimum rate for female workers of 18 years of age and over, other than casual workers, is 5d. per hour with overtime at 6d. per hour, and in the case of casual workers 3d. per hour, with overtime at 4d. per hour.

Denbigh and Flint.—An Order continuing from February 16, 1928, until February 15, 1929, the minimum and overtime rates of wages at present in force for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are 37s. per week of 61 hours for team-men, cattlemen, cowmen, shepherds and bailiffs, and 30s. 6d. per week of 50 hours for other male workers, with overtime in each case at 9d. per hour. The minimum rate for female workers of 18 years of age and over is 5d. per hour, with overtime at 6½d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

Question in Parliament.—On February 16, Captain CROOKSHANK asked the Minister of Agriculture if his attention has been called to the action of certain employers of agricultural workers who have reduced the wages of their employees when they have become entitled to old age pensions on attaining the age of 65; and what action he proposes to take in the matter?

Mr. GUINNESS replied that "Certain cases have been reported to me where employers are alleged to have reduced the wages of agricultural workers on their becoming entitled to the contributory old age pension at the age of 65. The receipt of an old age pension makes no difference to the employer's obligation under the Agricultural Wages (Regulation) Act to pay a worker wages at not less than the minimum rates fixed under the Act. Exemption from the minimum rates of wages is only permissible in the case of workers in respect of whom a permit of exemption has been granted by the local Agricultural Wages Committee. Such a permit may be granted only in a case where a worker is so affected by any physical injury or mental deficiency, or any infirmity due to age or to any other cause, that he is incapable of earning the minimum rate. I would point out that the rates of wages are fixed by the County Agricultural Wages Committees, and I have no power to intervene, but I am bound to enforce the observance of the rates which they have fixed."

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending February 15 legal proceedings were instituted against four employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows:—

County	Court	Fines	Costs	Arrears of wages	No. of workers concerned.
		£ s. d.	£ s. d.	£ s. d.	
Hereford ..	Bromyard	1 0 0	—	1 1 0	5
Dorset ..	Gillingham	1 0 0	0 10 0	7 17 3	1
Yorks, N.R.	Wath*	—	2 2 0	18 0 0	2
Carmarthen	Llandilo*	—	2 4 0	15 0 0	1
		£2 0 0	£4 16 0	£41 18 3	9

* Dismissed under the Probation of Offenders Act.

* * * * * *

Foot-and-Mouth Disease.—Since the report in the last month's issue of this JOURNAL, 31 outbreaks of foot-and-mouth disease have been confirmed in Great Britain. These outbreaks were in the following counties: Leicester, 7; Lincoln (Lindsey), 10; Nottingham, 6; Derby, 3; York, (West Riding), 2; Surrey, 2; and Warwickshire, 1.

The number of outbreaks confirmed since January 1 last is 75, involving 11 counties, and the slaughter of 2,247 cattle, 2,904 sheep, 1,223 pigs and 5 goats.

* * * * * *

NOTICES OF BOOKS

Cheshunt Experimental and Research Station: Twelfth Annual Report, 1926.—The Director's Report for 1926 of the work of this Station will prove interesting and useful to all who have attempted to grow plants under glass. The year 1926 was not a good one for the tomato growers, for crops were small and prices low, so that the total

returns were much below the normal; yet the cost of production still remained high, for these growers feed their plants liberally. Some have used stable manure in quantities up to 80 tons to the acre, whilst the majority would apply quantities between 30 and 50 tons; yet in an experiment conducted at the Station, where plots received respectively 15, 30, 60 and 90 tons per acre, plus the usual quantity of artificials, no difference in vegetative growth or weight of crop was detected. In other words, no benefit accrued by increasing the dressing beyond 15 tons per acre, yet this soil had received no stable manure during the three previous years. If this result is confirmed in future years, a great economy in production should be possible. The addition of freshly cut grass cuttings to the soil before planting, has again increased the yield from tomatoes. Synthetic manure prepared by the A.D.C.O. process gave slightly better results than stable manure.

Where carbon dioxide gas was supplied to the houses, an increase was obtained, so there seems little doubt that the tomato plants can make good use of carbon dioxide in larger quantities than is found in air. For supplying carbon dioxide, the apparatus giving the best results was a portable stove which burns patent fuel almost completely to carbon dioxide. The crop in this experiment was increased from 16 to 30 per cent.

Experiments have been conducted with cucumbers also. The workers in the Mycological and Entomological Departments have been experimenting with fungus diseases on such glasshouse crops as tomatoes, cucumbers, hyacinths, arum lilies, and even strawberries.

Unless thoroughly watered during the winter months, the soil, in glasshouses, has a tendency to dry out, when the finer rootlets suffer injury and often become attacked by the black dot fungus; and this early drying out of the soil, coupled with prevailing cold nights, seems to have checked the swelling of fruits and depressed the yield considerably. Winter flooding of soils with some 200,000 gallons of water is recommended.

The report is so full of results of real practical importance that it should be read by every grower of glasshouse crops.

* * * * * *

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